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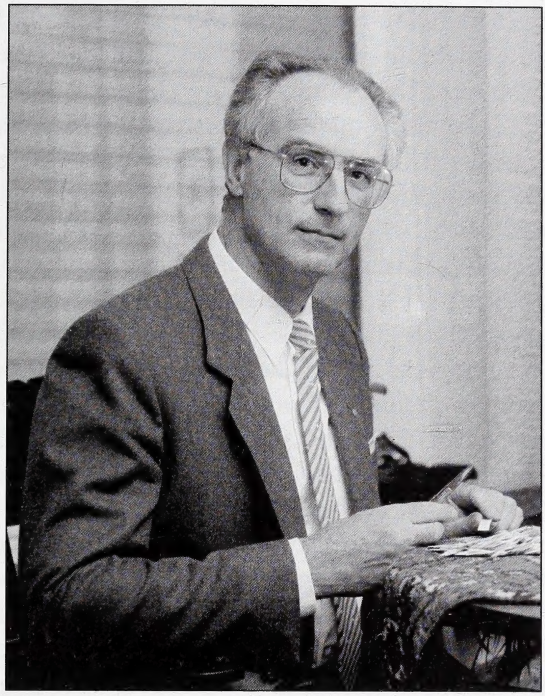

Clas Michael Naumann zu Königsbrück

26.06.1939 – 15.02.2004

On 15th February 2004, Clas Naumann passed away at his home in Wachtberg-Pech, near Bonn, Germany. He had been fighting a severe cancer over the past years, a fight which he ultimately lost just six weeks before his official retirement from the directorship of the Zoological Museum Alexander Koenig at Bonn. With his tragic death we lost an inspiring and truly outstanding friend and colleague, European entomology has lost one of its leading and most influential lepidopterists, and SEL has lost one of its Honorary Members. Clas Naumann is survived by his wife Dr. Storai Naumann zu Königsbrück - Nawabi, and their two children, Alexander and Roxana Naumann.

Clas Naumann was born on 26th June 1939 at Dresden, as the only son of Dr. Eberhard Naumann zu Königsbrück and his wife Freda-Irena Naumann, nee Hannemann. The first years of his life were spent at the family estate at Königsbrück near Dresden, but his early childhood was overshadowed by the raging Second World War, which forced the family to flee Königsbrück, leaving all belongings behind, in early 1945, when Clas was just over five years old. After spending a few years near Hameln and in Wilhelmshaven, the family eventually found a new home at Braunschweig, where his father could work with the forestry service. Eberhard Naumann, a forester, devoted general naturalist, and keen beetle collector, successfully

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planted the seeds during his son's youth for the joy and rewards of observing and studying natural history. During his years as a school boy Clas' early interests in nature, especially in insects, were reinforced by contacts with local entomologists, such as the late Fritz Hartwieg, author of a comprehensive regional study of the Lepidoptera of the Braunschweig area (Hartwieg 1958). This and other important contacts soon rendered butterflies and moths Clas Naumann's prime objects of study. His very first publication which appeared while he was still in high school thus dealt with his Lepidoptera findings during a summer holiday spent with his parents in 1956 near Maria Taferl in Austria (Naumann 1958).

Following his high school graduation, he moved in 1959 to Tübingen in southern Germany to attend for one year the local "Leibniz-Kolleg" and then to enrol at the university. Firstly studying chemistry, but without genuine interest in the matter, he soon changed his main subject to biology where his real interests had already been for some time. It was during his student years at Tübingen, an area still very rich in insects in those days, when his interests in Lepidoptera became finally focussed on Burnet Moths, specifically the genus *Zygaena*. With his open and outgoing attitude, he soon made contact with the leading Zygaenidae specialists at the time, notably Burchard Alberti and Hugo Reiss. At Hugo Reiss's home in nearby Stuttgart, he was able to admire for the first time a large comprehensive collection exclusively made of Burnet Moths, which left a lasting impression on the young student and keen collector he had become by that time. Already in 1966, in his second entomological publication, he described a new Burnet species from southern Turkey, *Zygaena problematica* Naumann, 1966, following a three month collecting expedition to Eastern Turkey which he had planned himself and jointly undertaken with a fellow undergraduate biology student from Tübingen university. Despite a lasting broader interest in Lepidoptera, and, later as a zoologist, with a solid background from classical training leading to general appreciation of all organisms much beyond insects and arthropods, his own group remained the Zygaenidae, with a life long obsession for the red-coloured Burnet Moths of the genus *Zygaena*.

After obtaining his biology degree from the Eberhard-Karls University at Tübingen, he moved to the University of Bonn for his dissertation, where Günther Niethammer, a renowned ornithologist and systematic biologist, became his supervisor. Not being allowed to work for his Ph.D. on Zygaenidae, his "hobby group", the Sesiidae were chosen to be the subject of his thesis, a work which turned into a full phylogenetic analysis of the Holarctic Sesiidae (Naumann 1971). This thorough study applied for the first time consistently and successfully the principles of phylogenetic systematics, as recently formulated by Willy Hennig (1966), towards a revision of a larger group within the Lepidoptera. Being at the forefront of systematic research at the time, his thesis was subsequently translated into English (Naumann 1977a). He kept a lifelong interest in Clearwing Moths, which led him much later to take on the editorship for a comprehensive and fully illustrated treatise of Palaearctic Sesiidae as a first volume of a new handbook series (Spatenka et al. 1999).

Following the completion of his Ph.D. thesis and its successful defence in January 1970, he took up an opportunity through a partnership between the Universities of

Cologne, Bochum, and Bonn, and the University of Kabul to enlist for an academic exchange program with Afghanistan, a country which had fascinated him already as a school boy and student by reading classical travel literature from the 19th century. For his postdoc years Clas Naumann thus went as a guest lecturer in zoology to Kabul University, where it was one of his several, partly self appointed duties to build up a zoological collection and a small museum for the university. The three years he spent in Afghanistan became most influential for his further professional and personal life, and lasted in a lifelong affection for that remote country, her people and nature. He already had acquired a predilection for the Middle East and Central Asia as that part of the Palaearctic region with the largest and least explored high mountain areas and home of a highly specialised but still surprisingly diverse fauna and flora. By quickly learning the language and adopting to the culture of his host country, he made good use of his stay by organising and engaging in a series of excursions and extensive field work throughout Afghanistan, which brought him to such remote areas as Nuristan and Registan, the provinces of Badakhshan and Paktia, as well as to the Wakhan Valley in the Afghan Pamirs (Naumann 1974a). These field trips and expeditions, apart from many surprise findings for different groups of animals and plants (e.g., Naumann & Niethammer 1973), also led to the discovery of a number of new *Zygaena* taxa, including one new species (Naumann 1974b, 1977b).

With the overthrow of the former Royal Afghan government in 1973, which later led to a military coup, the invasion of the country by the Soviet Union, and a raging civil war until recent times, a continuation of his stay and especially field work became increasingly difficult. After he returned to Germany, Clas Naumann first moved back to Bonn but then took a position as lecturer for zoology at the University of Munich in 1975. He continued to work up the many results and collections from his Afghanistan field studies, which he also generously shared with many colleagues and specialists for study and publication (e.g., Aussem 1980; Eisner & Naumann 1980; Efetov 1994). His personal affection for Afghanistan also turned into a permanent relationship for his private life by marring in 1974 Storai Nawabi, an Afghan zoologist who had come to Bonn university with the same academic exchange program which had brought him to Kabul. Their happy marriage and Storai's strong and continued support for his studies were a major contributing factor for Clas Naumann's later academic career, which he admitted on many occasions.

In 1977, a professorship for a newly established section for morphology and systematic zoology at the University of Bielefeld became available, for which Clas Naumann successfully applied. After establishing the new section with all laboratories and facilities literally from an empty office space, he soon assembled a young and increasingly active research team. Under his supervision and leadership a growing number of students received their training and graduated, which also yielded a series of studies on different aspects of Zygaenid morphology and ecology covering a wide array of complementary approaches from larval morphology and ultrastructure (Bode & Naumann 1987; Naumann & Feist 1987; Franzl et al. 1988; Naumann 1988) to chemical ecology (Priesner et al. 1984; Witthohn & Naumann 1987; Ockenfels et al. 1993), as well as behavioural and population genetic studies (Hille & Naumann

1992; Heine & Naumann 1994), without neglecting at the same time classical natural history, taxonomy, and faunistics (Naumann & Naumann 1980; Tremewan & Naumann 1989; Naumann et al. 1993; Naumann 2003). The studies and theses undertaken under his supervision were by no means restricted to the genus *Zygaena*, but also dealt with other Lepidoptera taxa outside the Zygaenidae (Rammert 1987; Häuser et al. 1993; Speidel et al. 1996). In his mind all singular results could be usefully brought together to resolve the phylogeny of the group of interest, in his case the Zygaeninae (Naumann 1977c, 1985, 1990; Naumann et al. 1999). He considered the analysis of phylogenetic relationships an essential pre-requisite for attempting to understand the evolution of a group, which he regarded as the ultimate scientific goal. Such a highly integrative approach cannot be achieved by pursuing only short term projects, and it was his reason for choosing to become a specialist for a single group of Lepidoptera in the long term. While at Bielefeld, he also initiated a series of international workshops on Zygaenidae which is still continued today, several of which were published as separate proceedings or as series of important papers by many of the contemporary specialists in the field (e.g., Dutreix et al. 1992; Tremewan et al. 1999).

In 1988 he successfully applied for the vacant position of director of the Zoological Museum Alexander Koenig at Bonn, the institution in which he had already worked as a Ph.D. student, and he was appointed on 1st July 1989. The museum had been struggling at the time through a rather difficult period, and the directorship was now linked to a newly established chair at the University of Bonn, which effectively meant to unite two jobs in one position. Clas Naumann mastered this challenge, and gradually turned the museum into a lively part of the university and an attractive place for graduate students in zoology, without losing out on any of the museum's genuine tasks and obligations (Naumann 1999). For his own research he continued to actively apply emerging techniques and new approaches, and under his hands the museum obtained new laboratories for biochemical analysis, and, more recently, for nuclear sequencing techniques. He still maintained his own focus on Burnet Moths, but apart from the application of new methods he also widened his geographic focus, now concentrating on relatives of the genus *Zygaena* from the Afrotropical region (Naumann & Edelmann 1984; Klütsch et al., in press).

Clas Naumann was a practising entomologist by conviction, and throughout his life he always kept some time for field work, breeding, and looking after his collection. He took much joy in discovering a population or specimens of a rare species in the field, in breeding some *Zygaena* life stock at home, in dissecting newly obtained specimens in the laboratory, as well as in re-arranging his own collection of Burnet Moths, the latter activity usually happening only late at night or during weekends. For much of what he did for entomology he was also driven by aesthetic motives, for which one can clearly see evidence in the way he set specimens, took photographs, prepared illustrations for presentations and publications, or even just prepared specimen labels. He was also keen to collect books and kept a private library of many rare entomological publications, even including complete runs of many journals meticulously bound in perfect shape.

An essential part of all his entomological activities were excursions and field work, which he often referred to as the most delightful part of the entomological business. His personal quest to possibly encounter and study all known *Zygaena* species and close relatives in their natural habitats took him to practically all countries and regions in central and southern Europe, northern Africa, the Middle East and Central Asia, but also to India, China, Japan, Saudi Arabia, Yemen, Ethiopia, Kenya, and South Africa. He often took students or colleagues along for those fields trips, and the author particularly remembers several joint expeditions targeting single *Zygaena* species known from isolated high mountain ranges in Iran and northern Pakistan in 1979, 1980, and 1982, during which often several days or weeks had to be spent without seeing a single Burnet Moth. It also has to be mentioned, however, that several close relationships developed during such expeditions and field trips, particularly with colleagues also interested in Zygaenidae, were discontinued by him during the later years of his life, often without much apparent reason. The ever increasing workload in his job leaving himself with less time for field work and research, and the beginning affects of his illness might have contributed to such discontinued cooperation, an attitude otherwise totally untypical for Clas Naumann.

Aside from pursuing his own scientific interests, Clas Naumann was always ready to generously come to the support of fellow researchers and entomologists in need of help. After a catastrophic flooding which destroyed literally over night almost the complete natural history holdings and library of the Museum Ferdinandeum of Innsbruck in August 1985, he immediately initiated and carried through a successful donations campaign ("Entomologen helfen Tirol – Entomologists in support of Tyrol"). Apart from bringing together substantial funds and in-kind support from many private and institutional sources to help quickly restock part of the institutional library and collection facilities, the success of this international initiative also helped to eventually convince the provincial government of Tyrol to invest in new facilities for the museum leading to a new building for the natural history collections. More recently, following the end of the Taliban regime in Afghanistan, Clas Naumann engaged himself immediately in fund raising and in rallying support to help rebuild Kabul university, for which he also re-activated the long dormant partnership with his own university in Bonn. Already weakened by his terminal illness he travelled twice to Kabul in 2002 and in 2003 to personally deliver the funds raised and to find out on the most urgent needs on the spot.

Many entomologists, particularly from Eastern Europe, also benefited from Clas Naumann's tireless efforts in providing private or institutional support. Following two visits to the Zoological Institute in St. Petersburg in 1992 and 1993, he voluntarily took over the membership administration for foreign members of the Russian Entomological Society in 1993. Largely due to his voluntary work and promotion of membership in Western Europe and oversees which yielded a stable income of hard currency, the society could continue the production of its journal "Entomologitsheskoje Obozrenie" and thus could survive economically the difficult first years after "Perestroyka." The Russian Entomological Society paid tribute to these efforts by electing Clas Naumann an Honorary Fellow in 1994.

Having joined SEL already in 1977, Clas Naumann was actively involved in the society for a long time. He was a regular participant, presenter, and chairman at several of SEL's European Congresses of Lepidopterology, and he was elected an SEL Honorary Member in 2000 (see also, SEL News 33: 17). He had been approached many times whether to take on a position within SEL Council, but he always declined to be nominated by saying he could only seriously consider a nomination after his retirement.

As a result of his outstanding reputation, he served on numerous academic and administrative boards and committees, such as in the permanent review panel for zoology for the German Research Foundation (DFG) from 1993 to 2000, as well as on the Council of the German Zoological Society (DZG) from 1987 to 1994, and he was a much sought expert for various ad hoc review panels and visiting groups assessing many national and international scientific institutions. Apart from his time in Kabul, he also held visiting short term lecturerships at the Universities of Moscow, Kyoto, Marseille, and Tehran, as well as one from the Scandinavian Entomological Societies. In addition to regularly reviewing manuscripts for Nota lepidopterologica as well as many other journals, he was directly involved in the editorship of several entomological journals and publication series. In 1999 he took on the task of managing editor for the "Entomologische Zeitschrift", the oldest existing non-professional entomological journal published in German, a position which he actively fulfilled until the end of 2003 (e.g., Naumann 2003). For his many contacts and generous sharing of information and material, the names of several new taxa from different groups were dedicated to his memory, including two species of Sesiidae (*Lenyra naumanni* Arita, 1989; *Dipchasphecia naumanni* Gorbunov, 1991), and two Zygaenidae (*Adscita naumanni* Efetov, 1994; *Zygaena naumanni* Hille & Keil, 2000).

Apart from his many scientific contributions and lasting achievements as an entomologist, Clas Naumann will perhaps mostly be remembered by his immensely positive, open, always interested, and most constructive attitude towards other colleagues, and especially students. These facets of his character, in combination with an enormous energy, hardly anyone could resist upon first encounter. Through his constantly inspiring, moving, and supporting students and colleagues, he became probably more influential to European entomology than by his scientific work alone. With this loss of a great character and personality, the entire scene of European Lepidopterists has suffered, but we will truly remember Clas Naumann as one of its most motivating members.

Clas Naumann's private Lepidoptera collection of more than 60.000 specimens, mostly of the genus *Zygaena*, was bequested to his former institution, the Museum Alexander Koenig in Bonn, where it will eventually be housed in a new building for the entire entomological department now under construction, which will carry his name. A more comprehensive obituary of Clas Naumann's academic life including a complete list of his publications will appear in a special forthcoming issue of the "Bonner Zoologische Beiträge," the main journal published by the Zoologisches Museum and Forschungsinstitut Alexander Koenig. His list of publications containing more than 150 titles will not be reprinted here, but a number of selected contributions is included below. Further obituaries for Clas Naumann have been or will be published shortly in issues of "Entomologische Zeitschrift" and "Decheniana".

For the compilation of this obituary, I would like to acknowledge the most helpful support received from Christoph Esch (Münster), Axel Hofmann (Breisach), Niels P. Kristensen (Copenhagen), Bernard Landry (Genève), Storai Naumann-Nawabi (Wachtberg-Pech), Michael Schmitt (Bonn), Axel Steiner (Stuttgart), Gerhard Tarmann (Innsbruck), and Thomas Wagner (Koblenz). The photo of Clas Naumann has been taken by Christoph Esch in 1989.

CHRISTOPH HÄUSER

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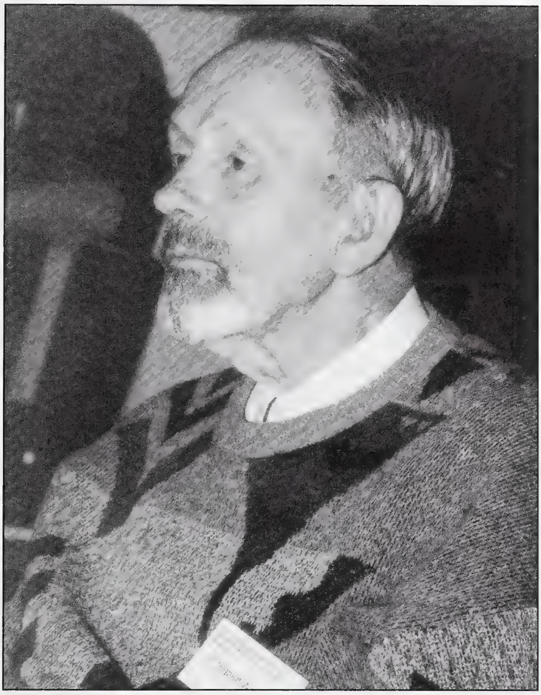

Dr Pater Sigbert Wagener

29 October 1919 – 13 April 2004

With deep regret, the SEL Council has to announce the death of our honorary member, Dr Pater Sigbert Wagener, on 13 April 2004.

Sigbert Wagener was born on 29 October 1919 in Krefeld (Germany) and he was baptised as Karl Emil. After finishing the "Volksschule" and the "Oberrealschule" in Krefeld, he studied in the private school of the episcopal monastery in Bensheim and till his leaving examination in 1938 the old "Kurfürstliche Gymnasium". Three days later, he started as a novice in Stühlingen where he entered the Capucine Order on 29 March 1939.

His philosophy studies, then undertaken in Krefeld, were abruptly disrupted by the Second World War which led him to North Africa. He was taken prisoner by the Americans in 1943 and spent the rest of the war in Algeria and Canada. Following his release, he was able to take his oath, and on 19 March 1948 he was ordained by Bishop Heinrich Roleff in Münster.

Dr Pater Sigbert Wagener during the SEL Congress at Korsør (Denmark), June 2002 (Photograph: Dr. T. N. Kristensen).

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After his theology studies, he started his natural history studies in 1948 at the universities of Münster, Heidelberg and Mainz. In Mainz he passed the exams for teaching, and in 1956 he was promoted as Dr. rer. nat. In October 1957 he started his teaching career at the Capucine Monastery School in Bocholt, the present day Saint-Josef-Gymnasium. At first he taught all natural history courses as well as geography and even sport, but later on he specialised in biology, chemistry and geography. After about 20 years, the last ones of which he acted also as study director, he received his pension. Apart from his teaching activities in school, he performed the duties of a priest every Sunday and on Catholic holidays in the parish of St. Ludgerus at Spork near Bocholt. He also acted as an architect during the rebuilding of the monastery (1969–1971) when many of his ideas where implemented in the new buildings. It was therefore hard for him to be obliged to move to Oberhausen-Sterkrade in July 2000 because the Bocholt monastery was closed down.

Sigbert was interested in butterflies from the age of 14. This early interest grew into an intensive involvement in the study of entomology, what gave him later the nickname of "die Motte" [the moth]. He observed butterflies and moths during excursions of weeks, and even months, which took him to Italy, Greece, Iran and Turkey. His last expedition to Turkey, Syria and Jordan even lasted 5 months!

After many years of hard work, the well-known and greatly appreciated three-volume work "Die Tagfalter der Türkei unter besonderer Berücksichtigung der angrenzenden Länder" [The Butterflies of Turkey with special attention to the adjacent countries] was published with the co-authorship of Gerhard Hesselbarth (Diepholz) and Harry van Oorschot (Amsterdam). Apart from this monumental work, Sigbert also published an important series of shorter and longer scientific studies (see bibliography).

His Lepidoptera Collection contained more than 100,000 specimens, most of them caught and set by himself. Even during the last months before his death, he rearranged 25,000 specimens according to the new systematics before moving his entire butterfly collection to the Museum Alexander Koenig in Bonn. Other collections (Coleoptera, Heteroptera, Trichoptera etc.) found their way to several museums where specialists in these groups are active.

Sigbert was not only interested in butterflies, but was also committed to nature conservation in general. He spent many Sunday afternoons with students in the Burloer Venn, to restore this natural area to its original state. This pilot project attracted much interest from German official institutions and subsequently, he became involved in many other nature conservancy projects as a consultant and later on he even became an official advisor for the Landesanstalt für Ökologie [Ministry of Ecology]. For all these activities, he was honoured with the "Meigen-Medaille" of the Deutsche Gesellschaft für allgemeine und angewandte Entomologie [German Society of general and applied Entomology], with the "Verdienstorden des Landes" of Nordrhein-Westfalen, and with the "Bundesverdienstkreuz 1. Klasse" of Germany.

Sigbert was also very active in some entomological societies, not just as an invaluable ordinary member, but also on the Council. He was one of the Founder Members of the Societas Entomologica Europaea, on the Council of which he occupied the chair of Membership Secretary from the very start during the founder meeting on 18–19

September 1976. In 1981, he became the Treasurer of SEL at a time when the Society suffered a debt of 10,000 DM (ca. 5,000 €). In 1992, after reversing the society's account to a credit of 10,000 DM, he stepped down. His 16 years in office was recognised by awarding him Honorary Membership of the Society during the 1992 Congress in Helsinki. He edited the first eight SEL newsletters and compiled the first membership lists. He attended all Council Meetings and all SEL Congresses until the 2002 one in Korsør (Denmark). All SEL members are greatly indebted to Sigbert, because without him, the Society surely would not be as it is today.

During that 2002 congress, Sigbert invited the remaining founding members and some close friends for a "farewell drink": Rienk de Jong, Jurate and Willy De Prins, Jane and Barry Goater. He felt at the time that it would be his last Congress. However, his entomological activities did not cease then. He obtained a scholarship, at the age of 83(!), to study the butterfly collection in the Zoologisk Museum in Copenhagen, and he was planning to apply for a similar scholarship at the Natural History Museum in London. He learned to master several programmes on a laptop and a sophisticated digital camera to photograph type specimens and other butterflies for a forthcoming review of the genus *Melanargia*, his pet group. It is to be hoped that this review will ultimately be finished by another lepidopterist, because many individual species have been treated already in detail by Sigbert himself.

Since the end of 2003, Sigbert suffered more and more from respiratory problems, but active as he was, he still visited the Zoological Museum at Amsterdam monthly, and also some other scientific institutions, carrying with him a bottle with oxygen, until tuberculosis forced him to enter the hospital on 1 April where he ended his earthly life on 13 April 2004, early in the morning.

Sigbert will remain in the memories of all entomologists who have known him as a friendly colleague, who never put himself higher than the others, spiritual in conversation and most enlightened during discussions. He was an everlasting source of inspiration during all our meetings in Amsterdam, Antwerp, Bocholt, the SEL Congresses or even during the short period we travelled together in Turkey. **R.i.P.**

Dr. Pater Sigbert Wagener

29. Oktober 1919 – 13. April 2004

Tief betrübt gibt der SEL-Vorstand Nachricht vom Tod unseres Ehrenmitglieds Dr. Pater Sigbert Wagener am 13. April 2004.

Sigbert Wagener wurde am 29. Oktober 1919 in Krefeld geboren und auf den Namen Karl Emil getauft. Nach der Volksschule und der Oberrealschule in Krefeld besuchte er die private Schule des bischöflichen Klosters in Bensheim und dann bis zum Abitur im Jahre 1938 das alte „Kurfürstliche Gymnasium". Schon drei Tage nach seinem Schulabgang begann er als Novize in Stühlingen und trat dort am 29. März 1939 in den Kapuzinerorden ein.

Das Studium der Philosophie, dem er sich in Krefeld widmete, wurde jäh vom

Zweiten Weltkrieg unterbrochen, der ihn nach Nordafrika führte. Im Jahre 1943 geriet er in amerikanische Gefangenschaft und verbrachte den Rest des Krieges in Algerien und Kanada. Nach seiner Entlassung konnte er dann das Gelübde ablegen und erhielt am 19. März 1948 von Bischof Heinrich Roleff in Münster die Ordination. Nach den theologischen Studien begann er 1948 mit dem Studium der Naturwissenschaften an den Universitäten in Münster, Heidelberg und Mainz. In Mainz legte er das Lehramtsexamen ab, 1956 wurde er zum Dr. rer. nat. promoviert. Im Oktober 1957 trat er sein Lehramt an der Schule des Kapuzinerklosters in Bocholt an, dem heutigen St. Josef- Gymnasium. Anfangs unterrichtete er alle naturwissenschaftlichen Fächer einschließlich Geographie und sogar Sport, später spezialisierte er sich auf Biologie, Chemie und Erdkunde. Nach rund 20 Jahren, von denen er in den letzten auch das Amt des Studiendirektors bekleidete, trat er in den Ruhestand. Neben der Unterrichtstätigkeit versah er jeden Sonn- und Feiertag auch sein Priesteramt in der St. Ludger-Pfarrei in Spork bei Bocholt. Während des Umbaus des Klosters (1969–1971) nahm er sogar Architektenaufgaben wahr und viele seiner Ideen sind in den Neubauten verwirklicht. Es traf ihn daher hart, als er im Juli 2000 nach Oberhausen-Sterkrade umziehen mußte, weil das Kloster in Bocholt geschlossen wurde.

Sigbert interessierte sich schon als 14-Jähriger für Schmetterlinge. Dieses frühe Interesse wuchs zu einer intensiven Beschäftigung mit der Entomologie, was ihm später den Spitznamen „die Motte“ eintrug. Auf wochen- und sogar monatelangen Exkursionen beobachtete er Tag- und Nachtschmetterlinge. Seine letzte Reise in die Türkei, nach Syrien und Jordanien dauerte nicht weniger als fünf Monate!

Nach vielen Jahren harter Arbeit konnte er – zusammen mit Gerhard Hesselbarth (Diepholz) und Harry van Oorschot (Amsterdam) – 1995 das bekannte und hochgeschätzte dreibändige Werk „Die Tagfalter der Türkei unter besonderer Berücksichtigung der angrenzenden Länder“ veröffentlichen. Außer diesem monumentalen Werk publizierte Sigbert eine bedeutende Reihe kleinerer und größerer wissenschaftlicher Arbeiten (vgl. Bibliographie).

Seine Schmetterlingssammlung umfasst mehr als 100.000 Exemplare, die meisten hatte er selbst erbeutet und gespannt. Noch in den letzten Monaten vor seinem Tod brachte er 25.000 Exemplare in eine neue systematische Ordnung, bevor seine ganze Tagfaltersammlung an das Museum Alexander Koenig in Bonn ging. Andere seiner Aufsammlungen (Coleoptera, Heteroptera, Trichoptera usw.) fanden ihren Weg zu mehreren Museen, wo die entsprechenden Spezialisten tätig sind.

Sigbert war nicht nur an Schmetterlingen interessiert, er engagierte sich auch grundsätzlich für den Naturschutz. Manchen Sonntag-Nachmittag verbrachte er mit Studenten in der Burloer Venn, um der Natur dort wieder zum ursprünglichen Zustand zu verhelfen. Dieses Pilotprojet fand große Aufmerksamkeit seitens der amtlichen Stellen, was dazu führte, dass er schließlich bei vielen anderen Naturschutzprojekten als Berater zugezogen wurde und später sogar als offizieller Beirat der Landesanstalt für Ökologie des Umweltministeriums bestellt wurde.

Für alle diese Aktivitäten wurde er mit der Meigen-Medaille der Deutschen Gesellschaft für allgemeine und angewandte Entomologie, mit dem Verdienstorden des Landes Nordrhein-Westfalen und mit dem Bundesverdienstkreuz 1. Klasse der Bundesrepublik Deutschland geehrt.

Sigbert war ein sehr aktives Mitglied einiger entomologischer Gesellschaften, nicht nur als willkommenes „einfaches" Mitglied, sondern auch im Vorstand. Er war einer der Gründungsväter der Societas Europaea Lepidopterologica (SEL) und schon von der Gründungsversammlung am 18./19. September 1976 an übernahm er das Amt des Mitgliedersekretärs. Im Jahre 1981 wurde er dann zum Schatzmeister gewählt, in einer Periode, in der die Gesellschaft mit 10.000 DM (fast 5.000 €) verschuldet war! Nachdem er die Konten des Vereins auf ein Guthaben von 10.000 DM gebracht hatte, konnte er 1992 das Schatzmeisteramt abgeben. Beim Kongress in Helsinki 1992 ehrte ihn der Verein für seine insgesamt 16jährige Amtszeit mit der Ehrenmitgliedschaft der Gesellschaft. Die ersten acht „Nachrichten"-Hefte und die ersten Mitgliederlisten wurden von ihm herausgegeben. Er nahm an allen Vorstandssitzungen und Kongressen, zuletzt 2002 in Korsør (Dänemark), teil. Die SEL-Mitglieder verdanken Sigbert viel; denn ohne ihn wäre der Verein heute nicht das, was er geworden ist.

Während des Kongresses in Korsør 2002 lud Sigbert die verbliebenen SEL-Gründungsmitglieder und enge Freunde zu einem „Abschieds-Umtrunk" ein: Rienk de Jong, Jurate und Willy De Prins, Jane und Barry Goater. Er fühlte wohl schon, dass es sein letzter Kongress sein würde. Doch seine entomologischen Aktivitäten waren noch nicht zu Ende. So erhielt er, mit 83(!), noch ein Stipendium zur Durchforschung der Tagfaltersammlung im Zoologischen Museum in Kopenhagen, und er plante, in gleicher Weise eines für das Natural History Museum in London zu beantragen. Er hatte den Umgang mit etlichen Programmen auf dem Laptop und mit einer leistungsfähigen Digitalkamera erlernt, um Typen-Exemplare und andere Falter für eine künftige Revision der Gattung *Melanargia*, seiner Lieblings-Gruppe, fotografieren zu können. Es wäre zu wünschen, dass diese Revision letztlich von einem anderen Lepidopterologen zu Ende gebracht wird, zumal Sigbert selbst viele Arten schon detailliert bearbeitet hat.

Seit Ende 2003 litt Sigbert zunehmend unter Atembeschwerden, was ihn freilich nicht von seinen monatlichen Besuchen im Amsterdamer Zoologischen Museum und in anderen Instituten abhielt, nur hatte er jetzt immer eine Sauerstoffflasche dabei. Die Tuberkulose zwang ihn schließlich am 1. April ins Krankenhaus, wo seinem irdischen Leben am frühen Morgen des 13. April 2004 das Ende beschieden war.

Sigbert wird allen Entomologen im Gedächtnis bleiben als ein liebenswürdiger Kollege, der sich nie über andere stellte, geistreich in der Unterhaltung und höchst lebhaft in der Diskussion. Er war eine unerschöpfliche Quelle der Inspiration bei allen unseren Begegnungen in Amsterdam, Antwerpen und Bocholt, bei den SEL-Kongressen und auch bei unserem kurzen Zusammensein auf der gemeinsamen Türkei-Reise. **R.i.F.**

WILLY DE PRINS

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New taxa of Lepidoptera described by Sigbert Wagener

Melanargia leda melli Wagener, 1961: 144.
Melanargia halimede gratiani Wagener, 1961: 153.
Melanargia halimede beicki Wagener, 1961: 153.
Melanargia meridionalis maritima Wagener, 1961: 154.
Melanargia meridionalis wenchowensis Wagener, 1961: 155.
Melanargia meridionalis tsinica Wagener, 1961: 155.
Melanargia meridionalis tapaishanensis Wagener, 1961: 155.
Melanargia montana chloris Wagener, 1961: 158.
Melanargia lugens hoenei Wagener, 1961: 158.
Melanargia lugens ahyoui Wagener, 1961: 159.
Melanargia lugens hengshanensis Wagener, 1961: 159.
Melanargia epimede corimede Wagener, 1961: 165.
Melanargia ganymedes walleseri Wagener, 1961: 172.
Melanargia ganymedes weigoldi Wagener, 1961: 172.
Melanargia asiatica dejeani Wagener, 1961: 172.
Melanargia asiatica armandi Wagener, 1961: 176.
Melanargia asiatisca elisa Wagener, 1961: 176.
Melanargia russiae eberti Wagener, 1975: 50–51, pls. 1–2.
Melanargia larissa lesbina Wagener, 1976: 40–43, 1 fig..
Melitaea arduinna kocaki Wagener & Gross, 1976: 229–232, 1 fig.
Melanargia evartianae Wagener, 1977 b: 75–80, 3 figs.
Melanargia syriaca kocaki Wagener, 1983 c: 257, pls. III–IV.
Melanargia larissa noacki Wagener, 1983 c: 286, pls. VII–VIII.
Boloria (Boloria) graeca karina van Oorschot & Wagener, 1990: 117–120.

Lepidoptera taxa named after Sigbert Wagener

Archon apollinus wageneri Koçak, 1976
Melanargia larissa wageneri Koçak, 1977
Polyommatus (*Agrodiaetus*) *sigberti* Olivier, van der Poorten, Puplesiene & DePrins 2000
Drymonia dodonaea wageneri de Freina, 1981
Micropterna wageneri Malicky, 1972

Nota lepid. **27** (1): 19–31

Beitrag zur Kenntnis der Typhoniini mit der Beschreibung von *Kalliesia irana* gen. et sp. n. aus dem Iran (Psychidae)

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Abstract. The genus *Kalliesia* gen. n. with the type species *Kalliesia irana* sp. n. is described from Iran. Within Psychidae, the new genus is placed in Typhoniinae: Typhoniini. The diagnostic characters of Typhoniini are revised at tribus and generic level. The genus *Eumelasina* Kozhanchikov, 1956 is transferred from Penestoglossini to Typhoniini and *Melapsyche* Kozhanchikov, 1956 syn. n. synonymised with *Typhonia* Boisduval, 1834. *Typhonia troughti* (Amsel, 1955) comb. n. is redescribed and compared with *Typhonia paulusella* (Caradja, 1921). Moths and genitalia of *Kalliesia irana* sp. n. and *Typhonia troughti* (Amsel, 1955) comb. n. are illustrated. A new generic key of Typhoniini is presented based on external characters.

Zusammenfassung. Die Gattung *Kalliesia* gen. n. mit ihrer Typusart *Kalliesia irana* sp. n. wird aus dem Iran beschrieben. Innerhalb der Psychidae erfolgt die Einordnung der neuen Gattung in die Typhoniinae: Typhoniini. Die diagnostischen Merkmale der Typhoniini werden auf Tribus- und Gattungsebene diskutiert. Die Gattung *Eumelasina* Kozhanchikov, 1956 wird von den Penestoglossini zu den Typhoniini transferiert und *Melapsyche* Kozhanchikov, 1956 syn. n. mit *Typhonia* Boisduval, 1834 synonymisiert. *Typhonia troughti* (Amsel, 1955) comb. n. wird ergänzend beschrieben und mit *Typhonia paulusella* (Caradja, 1921) verglichen. Falter und Genitalien von *Kalliesia irana* sp. n. und *Typhonia troughti* (Amsel, 1955) comb. n. werden abgebildet. Ein neuer Bestimmungsschlüssel für die Gattungen der Typhoniini wird basierend auf äußeren Merkmalen gegeben.

Key words. Psychidae, Typhoniini, key to genera, *Kalliesia irana* gen. et sp. n., Iran, *Eochorica, Melapsyche, Typhonia troughti*.

1. Einleitung

Im Juni des Jahres 2002 führten die Entomologen Axel Kallies, Axel Hofmann, Jörg-Uwe Meineke, Christoph Neumann und Gerry Tremewan eine Forschungsreise in den Iran durch. Hauptziel der Reise war die Weiterführung von Untersuchungen zur Fauna der Zygaenidae und Sesiidae des Iran. Ergebnisse dazu wurden bereits an anderer Stelle publiziert (Hofmann 2000, 2001; Kallies & Špatenka 2003). Während einer Exkursion in die Provinz Boyer Ahmad-Va-Kohgiluyeh wurden im zentralen Zagros Gebirge oberhalb des Gardaneh[1] Meymand in einer Höhenlage von etwa 2550 m Säcke einer Psychidenart gefunden, die sich nach dem Schlupf der Imagines als neu für die Wissenschaft herausstellte. Bei der nachfolgenden taxonomischen Bearbeitung und systematischen Einordnung dieser Art in die Typhoniini wurde deutlich, dass die Diagnose dieser Tribus zu präzisieren und der Status einiger Taxa zu diskutieren ist. Im Folgenden werden die Ergebnisse dieser Untersuchungen vorgestellt sowie ein Bestimmungsschlüssel der Gattungen der Typhoniini gegeben.

Abkürzungen

CAK	Collection Axel Kallies
CTS	Collection Thomas Sobczyk
SMNK	Staatliches Museum für Naturkunde Karlsruhe
ZSM	Zoologische Staatssammlung München
DZ	Diskoidalzelle

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[1] Gardaneh: iranisch für 'Pass'

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2. Die Tribus Typhoniini

Sauter & Hättenschwiler (1991, 1999) trennen die Typhoniinae der Palaearktis in die Penestoglossini, Dissoctenioidini und Typhoniini. *Dissoctenioides schwingenschussi* Rebel, 1934 ist die einzige bekannte Art der Dissoctenioidini. Acht Arten (inkl. *Eumelasina* Kozhanchikov, 1956, vgl. unten) werden zu den Penestoglossini gestellt. Mit etwa 20 Arten am umfangreichsten sind die Typhoniini. Ihr Verbreitungsschwerpunkt liegt im mediterranen Raum und erstreckt sich bis nach Vorderasien. Die Arten der Gattung *Eudissoctena* Rebel, 1934 sind bisher ausschließlich, jene der Gattung *Dissoctena* Staudinger, 1859 überwiegend aus Nordafrika bekannt. Am weitesten ist *Typhonia* Boisduval, 1834 verbreitet. Arten dieser Gattung kommen von Fernost bis zur iberischen Halbinsel vor und erreichen mit *Typhonia ciliaris* (Ochsenheimer, 1810) in Mitteleuropa die nördlichsten Vorkommen der Typhoniini.

Als differenzierendes Merkmal der Penestoglossini und Dissoctenioidini mit neun Adern aus der DZ der Vorderflügel verfügen die Typhoniini über 10 DZ-Adern. Die Kopfplatte der Puppe weist einen deutlichen Stirnhöcker und 5 Borstenpaare auf. Außer bei *Typhonia* sind die Flügel der Weibchen weitgehend reduziert. Die Weibchen verlassen den Sack und haben vollständig ausgebildete Beine, mit denen sie sich vom Sack entfernen. Die wenigen Beobachtungen zur Eiablage deuten auf die Bevorzugung mineralischer Substrate hin. Der Sack der Typhoniini ist röhrenförmig, distal nicht zugespitzt und mit feinem Sand oder kleinen Steinen bekleidet.

Aus dieser Tribus sind in der Palaearktis die Gattungen *Dissoctena*, *Eochorica* Rebel, 1940, *Eudissoctena*, *Melapsyche* Kozhanchikov, 1956 und *Typhonia* bekannt.

Die von Sauter & Hättenschwiler (1999) trotz der 10 Adern aus der DZ der Vorderflügel zu den Penestoglossini gestellte Gattung *Eumelasina* (Typusart: *Eumelasina ardua* Kozhanchikov, 1956) weist zahlreiche Merkmale der Typhoniini auf. Die Untersuchung von *E. ardua* (1♂ CTS) und *E. pliginskii* Kozhanchikov, 1956 (1♂, 1♀ CTS) sowie die Gattungsbeschreibung von Kozhanchikov (1956) deuten auf eine Zugehörigkeit zu den Typhoniini. Die Äderung und der Habitus zeigen keine Differenzen zu den Typhoniini, jedoch zu den Penestoglossini. Die beschriebene zweite Anhangzelle in der DZ der Vorderflügel ist nur bei *Eumelasina ardua* Kozhanchikov, 1956 schwach angedeutet. Die Kopfplatte der Puppen weist den für die Typhoniini typischen Höcker auf. *Eumelasina* wird auf Grund der Untersuchungen hiermit wieder zu den Typhoniini gestellt.

3. *Kalliesia* gen. n.

Typusart: ***Kalliesia irana*** **sp. n.** (hiermit festgelegt, monotypisch)

Beschreibung ♂. Kopf. Komplexaugen rund, keine Ocellen. Kleinster Augenabstand etwa 1,5facher Augendurchmesser. Labialpalpen auf ein Glied reduziert, kurz gedrungen, stark, fast schwarz sklerotisiert, mit haarförmigen Schuppen besetzt. Fühler mit 20–22 Gliedern (inklusive Scapus, Pedicellus und Fühlerendglied), Scapus, Pedicellus und Fühlerendglied ohne Kammzahnpaar, drittes Fühlerglied mit sehr kurzem Kammzahnpaar. Alle Fühlerglieder beschuppt, Kammzähne mit langen Saetae.

Beine. Vordertibien mit Epiphyse, mittlere Tibien mit einem, hintere mit zwei Spornenpaaren, das distale Spornenpaar kurz und eng anliegend. Alle Beine mit fünf Tarsengliedern.

Vorderflügel. Vollständig beschuppt, Schuppenklassen 5 und 6 (vgl. Sauter 1956), Außenrand mit lanzettförmigen, mehrspitzigen Schuppen besetzt. Apex gerundet, Vorderflügel mit 10 Adern aus DZ, diese durch sehr feine Ader geteilt. Querader zwischen R4 und M2 nicht (DZ erscheint dann in diesem Bereich offen) oder nur schwach sklerotisiert.

Hinterflügel. Vollständig beschuppt. Schuppenklasse 3–6 (vgl. Sauter 1956), Außenrand mit lanzettförmigen Schuppen. DZ durch Ader längs geteilt. SC durch Querader mit R verbunden, fünf Adern aus der DZ.

Abdomen. Gedrungen, mit haarförmigen und spatelförmigen Schuppen dicht besetzt.

Genital. Saccus kurz. Aedeagus leicht gekrümmt, ohne Cornuti.

♀. Pupifug, Körper walzenförmig, gestreckt.

Kopf. Fühler filiform, 15–18 Fühlerglieder, beschuppt. Labialpalpen auf einen kurzen stumpfen Kegel reduziert, stark sklerotisiert.

Flügel. Auf kleine Lappen reduziert, gut sichtbar. Beine voll entwickelt, Tarsen fünfgliedrig (keine Reduzierungen festgestellt). Vordertibien ohne Epiphyse, Mitteltibien mit einem, Hintertibien mit 2 Spornenpaaren.

Genital. Mit langen Apophysen und stark sklerotisierter Antevaginalplatte. Ovipositor im Ruhezustand sichtbar.

Puppe. Männliche und weibliche Exuvien schwach sklerotisiert. Kopf-Brustplatte mit vollständiger Anlage der Fühler- und Beinscheiden, Labialpalpenscheiden länger als die reduzierten Maxillarpalpenscheiden; deutlich ausgebildete Flügelscheiden; auf den Hinterleibssegmenten dorsal deutlich nach hinten gerichtete Dornenreihen.

Sack. Länge 10–12 mm, Durchmesser 2–3 mm. Röhrenförmig, gerade, Querschnitt kreisrund. Braun, mit Sand und feinen Körnchen bekleidet. An Säcke von *Dissoctena* erinnernd.

Systematische Stellung. Taxonomische Merkmale wie die doppelkammzähnigen Fühler und deren Beschuppung, die Anzahl der Adern und deren Verlauf, Sporne an Mittel- und Hintertibien der Männchen und weitere, oben bereits genannte Merkmale verweisen für *Kalliesia* gen. n. auf die Zugehörigkeit zu den Typhoniinae. Innerhalb dieser Unterfamilie wird die neue Gattung durch den Höcker und die fünf Borstenpaare auf den Kopfplatten der Puppen zu den Typhoniini gestellt.

Die Gattung *Kalliesia* gen. n. unterscheidet sich von den anderen Gattungen der Typhoniini durch die fünf Hinterflügel-Adern aus der DZ und dem Vorhandensein einer Epiphyse an der Tibia der Vorderbeine bei den Männchen. Nur *Dissoctena* Staudinger, 1859 weist ebenfalls fünf DZ-Adern im Hinterflügel auf, den Männchen dieser Gattung fehlen jedoch die Epiphysen an den Vorderbeinen.

Bei *Kalliesia* gen. n. sind alle Adern ungestielt, *Eochorica* Rebel, 1940 und *Eudissoctena* Rebel, 1934 sowie teilweise *Typhonia* weisen gemeinsam gestielte Adern M2+M3 im Hinterflügel auf. Im Gegensatz zu *Kalliesia* sind die Weibchen von *Typhonia* geflügelt. Die Weibchen von *Kalliesia* lassen sich durch die zwei

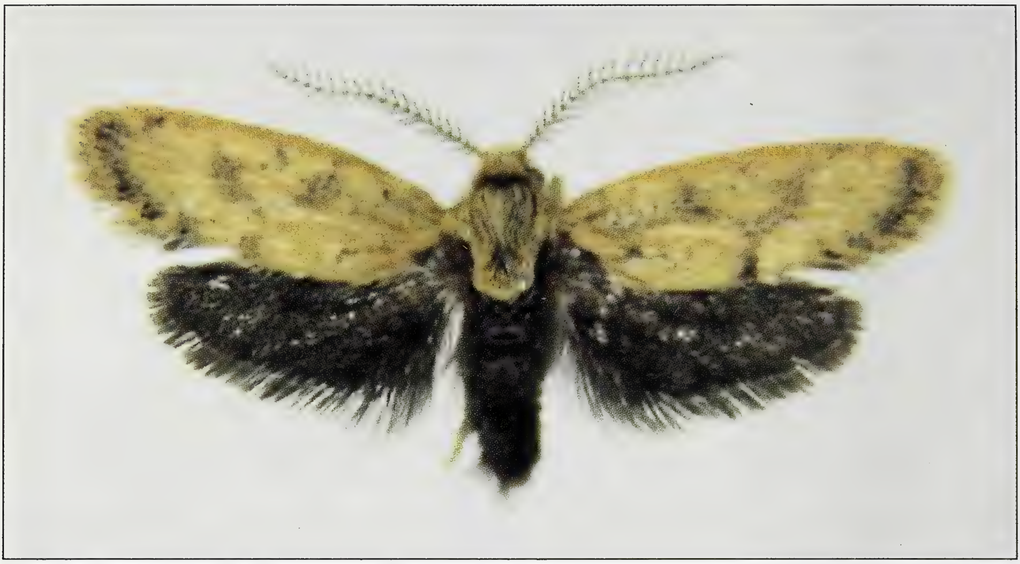

Abb. 1. *Kalliesia irana* sp. n., Holotypus ♂, Iran, Prov. Boyer Ahmad-Va-Kohgiluyeh, Gardaneh Meymand, 2550 m, 9.–10.vi.2002 (12. viii. 2002 e.l.), leg. A. Kallies, A. Hofmann, J. U. Meineke.

Spornenpaare an den Hintertibien von den anderen Gattungen der Typhoniini trennen. Nur die Fühler der *Eudissoctena*-Weibchen weisen ebenfalls weniger als 20 Glieder auf. Die Männchen von *Kalliesia* gen. n. fallen durch den starken Kontrast von Vorderflügeln (ockerbraun) zu Hinterflügeln (schwarz) auf. Innerhalb der Typhoniini tritt dieser intensive Kontrast bei keiner anderen Gattung auf.

Derivatio nominis. Die neue Gattung ist meinem Freund Axel Kallies, Melbourne, Australien gewidmet. Er sammelte die Säcke der nachfolgend beschriebenen Typusart dieser Gattung und züchtete die Imagines.

4. *Kalliesia irana* sp. n.

Material. Holotypus ♂ (Abb. 1): "Iran, Prov. Boyer Ahmad- | Va-Kohgiluyeh, Gardaneh | Meymand, 2550 m, | 9.–10.vi.2002, leg. A. Kallies, | A. Hofmann, J.U. Meineke et. al. [Unterseite] 12. viii. 2002 e.l." Der Holotypus befindet sich in CTS und wird später im Staatlichen Museum für Tierkunde Dresden deponiert. – Paratypen: 3♂, 10♀, gleiche Daten, aber Schlupfdaten 10.–19.viii.2002" (coll. CTS, CAK).

Beschreibung ♂. Maße. Körperlänge 3,8 mm; Vorderflügellänge 4,4–4,8 mm, Holotypus 4,6 mm (inkl. Fransen); Flügelspanne 9,5–10,5 mm (n=4).

Kopf. Fühler (Abb. 2) etwa 2/3 der Vorderflügellänge, doppelkammzähnig. Kammzähne im Bereich des 7.–11. Fühlergliedes größte Länge erreichend, Verhältnis Kammzahn zu Fühlerglied zwischen 1,9 und 2,1. Frons mit langen, strohgelben, haarförmigen Schuppen besetzt.

Thorax. Mit ockerbraunen haarförmigen Schuppen bedeckt; von einzelnen dunklen Borsten durchsetzt. Beine (Abb. 3) mit langen haarförmigen und kürzeren spatelförmigen strohgelben Schuppen. Vorderbein mit langer Epiphyse, Ansatz nach ca. 1/3 der Tibia, endet mit der Tibia (somit Länge der Epiphyse ca. 2/3 Tibienlänge).

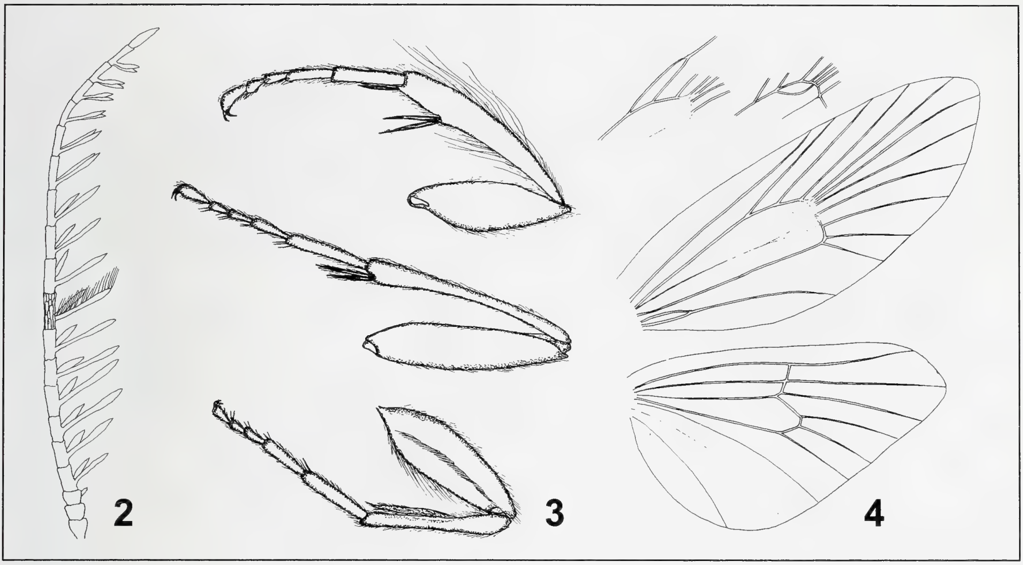

Abb. 2–4. *Kalliesia irana* sp. n., ♂. **2.** Fühler (Länge 2,7 mm). **3.** Vorder- (unten), Mittel- (Mitte) und Hinterbein (oben) (Gesamtlänge Vorderbein 3,2 mm). **4.** Flügelgeäder, mit Darstellung der festgestellten Variabilität.

Flügel. Vorderflügel gestreckt, ockerbraun mit schwärzlicher Zeichnung. Am Innenrand sehr helle Schuppen. Unscharfe dunkle Beschuppung vor allem im unteren Bereich der DZ, zwei undeutliche Flecken im Saumbereich sowie ein größerer Bereich am äußeren Ende der DZ. Unterseite flächig dunkelgrau beschuppt, an den Rändern und Adern heller. Im Flügelgeäder (Abb. 4) verschmelzen bei einem Exemplar R1 und R2 vor dem Saum, so daß nur neun Adern den Außenrand erreichen. Ein Exemplar mit Anhangzelle, zwei Exemplare mit eingeschobener Zelle. DZ durch sehr feine Ader geteilt, diese endet in der Zelle oder erreicht Verbindungssteg zwischen R4 und M2. Hinterflügel schwarz beschuppt.

Abdomen. Dorsal mit schwärzlichen Schuppen, durchmischt mit schwärzlichen Borsten, lateral schwarze Borsten, ventral einige bräunliche, breite Schuppen. Tergite und Sternite mit stärker sklerotisierten Partien, keine Dornenfelder auf den Intersegmentalhäuten.

Genital (Abb. 5). In Ventralansicht fast doppelt so lang wie breit. Tegumenhinterrand eingebuchtet. Valven und selbst der Sacculus überragen den Hinterrand des Tegumens. Valven distal mit feinen kurzen Saetae und kleinen, wenig sklerotisierten Höckern. Sacculus stärker sklerotisiert, mit neun Dornkegeln besetzt, kürzer als die Valve. Annellus mit kräftigen Dornen. Vinculum breit, Saccus kürzer als Breite des Vinculums. Aedeagus 765 µm lang, Querschnitt rund, in Lateralansicht proximal leicht gekrümmt, ohne Cornuti.

♀ (Abb. 6) (n=6)**.** Körper von Kopf bis Abdomenende 6–7 mm lang, gestreckt.

Kopf. Kleinster Augenabstand zu Augenhöhe im Verhältnis 1,3:1. Frons mit gelblichen und schwarzen haarförmigen Schuppen anliegend, Vertex mit gelblichen und schwarzen haarförmigen Schuppen abstehend besetzt. Labialpalpen mit langen

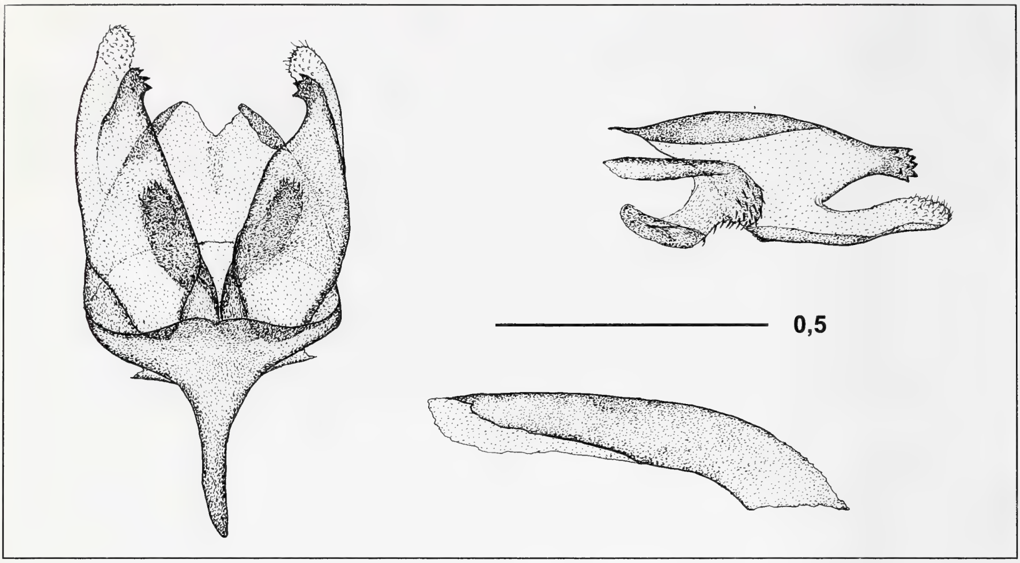

Abb. 5. *Kalliesia irana* sp. n., ♂ Genitalien (Maßstab 0,5 mm).

bräunlichen haarförmigen Schuppen. Fühler (Abb. 6) mit 15–18 Gliedern, mit hellbraunen, spatelförmigen, mehrspitzigen Schuppen dicht besetzt. Fühlerglieder 4–14 etwa doppelt so lang wie breit.

Thorax. Schwärzlich, lateral mit langen gelblichen haarförmigen Schuppen. Beine (Abb. 7) mit hellen, schmalen, spatelförmigen Schuppen besetzt.

Flügel. Vorderflügel stark reduziert, etwa 1 mm lang, lappenförmig, gelblich, mit gelblichen haarförmigen und gelblichen sowie schwärzlichen spatelförmigen Schuppen der Schuppenklassen 2 und 3 (Vgl. Sauter 1956) besetzt. Hinterflügel nur als winzige Lappen erkennbar, weniger als die Hälfte der Vorderflügel erreichend. Mit einzelnen gelblichen haarförmigen Schuppen besetzt.

Abdomen. Tergite und Sternite stark sklerotisiert, schwärzlich, lateral wie die Intersegmentalhäute durchscheinend. Tergite proximal mit dunklen Schuppen, distal mit schwärzlichen und einzelnen grauen haarförmigen Schuppen. Auf dem 7. Segment kranzförmig angeordnete, dichte, gewellte, cremefarbene Afterwolle.

Genital (Abb. 8). Ovipositor überragt das Abdomen im Ruhezustand um 1,2–1,4 mm. Segment VIII konisch, auf 3/4 anterio-dorsal deutlich stärker sklerotisiert, mit kurzem, nach anterior gerichtetem Apophysenpaar von 0,3–0,4 mm Länge; ventral stark sklerotisiert (Postvaginalplatte) und mit deutlich differenzierter, stark sklerotisierter Antevaginalplatte, diese ohne Dornen oder andere Strukturen; Antevaginalplatte mit halbkreisförmigen Hinterrand (= Bursabogen) und latero-anterior mit einem 1,9–2,0 mm langen Paar nach anterior gerichteter Apophysen. Papillae anales mit zwei Paar Apophysen; dorsales Paar mit 4,1–4,3 mm Länge fast die gesamte Abdomenlänge erreichend; ventrales Paar 1,2–1,3 mm lang.

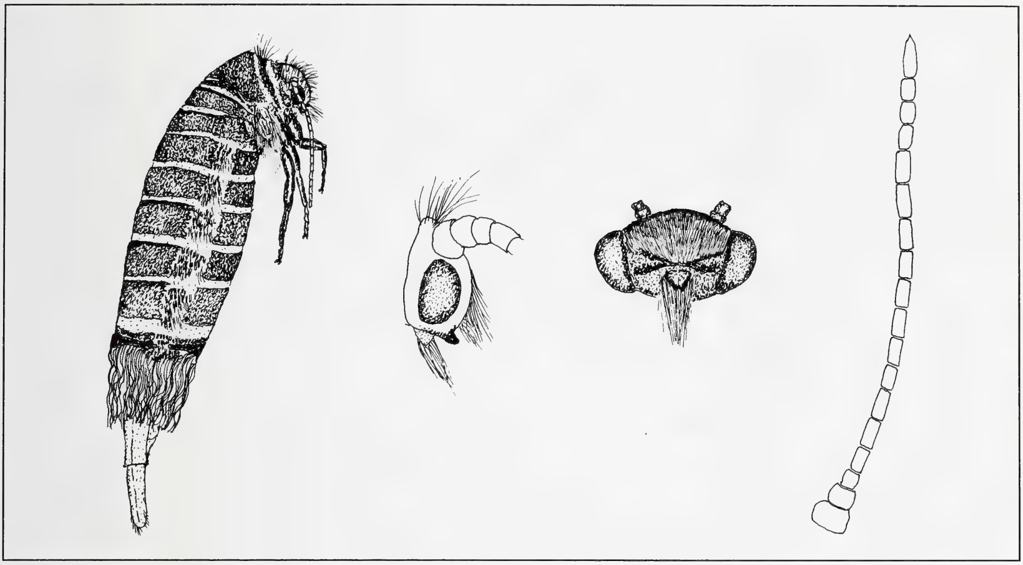

Abb. 6. *Kalliesia irana* sp. n., ♀. Links Gesamtansicht, Körperlänge 6,5 mm; Mitte, links: Kopf lateral; Mitte, rechts: Kopf frontal; Rechts: Fühler.

Puppe. Schwach sklerotisiert. Kopfplatte (Abb. 9) mit deutlich ausgeprägtem Stirnhöcker und fünf Borstenpaaren. Auf den Abdominalsegmenten 4–8 dorsal je eine nach hinten gerichtete, kräftige Dornenreihe. Abdominalsegment 4 mit einzelnen Dornen (5–10), andere Segmente mit 30–40 Dornen. Intersegmentalhäute mit sehr kleinen, abstehenden Dornen.

Säcke (Abb. 10). Länge 10–12 mm, Querschnitt rund, Durchmesser 2–3 mm, nicht gekrümmt, distal geringfügig verjüngt. Kein auffälliger Geschlechtsdimorphismus. Innen mit feinen Gespinstfäden ausgekleidet, außen mit kleinen braunen Steinchen und Erdkrumen besponnen. Beim Schlupf der Imagines schiebt sich die Puppe etwa ein Drittel aus dem Sack (etwa Ende der Flügelscheiden).

Vorkommen und Lebensweise. Die Säcke wurden in einer Höhenlage von 2550 m an einem nach Westen exponierten Hang oberhalb des Gardaneh Meymand gefunden (Abb. 11). Die Fundstelle ist ein pflanzenartenreicher Geröllhang oberhalb eines lichten *Quercus persica*-Waldes. Die Säcke saßen tagsüber etwa 5 bis 20 cm hoch an krautigen Pflanzen, überwiegend an einem weißblühenden Nelkengewächs.

Derrivatio nominis. Die Benennung der neuen Art erfolgt nach dem Fundland Iran.

5. Zum Status von *Typhonia troughti* (Amsel, 1955) comb. n. (Abb. 12)

Eochorica troughti Amsel, 1955: 12–13, Taf. 1 Fig. 10.

Material: Holotypus (ohne Fühler) ♂: „Typus", „18.x.1952, Jordan Valley, Zerqa R. Colony C. 100 m below s.l., at light, Trevor Trought", SMNK; 1 ♂ „Paratypus": gleiche Angaben, jedoch 25.x.1952, zusätzlich Schildchen GU 2279, SMNK.

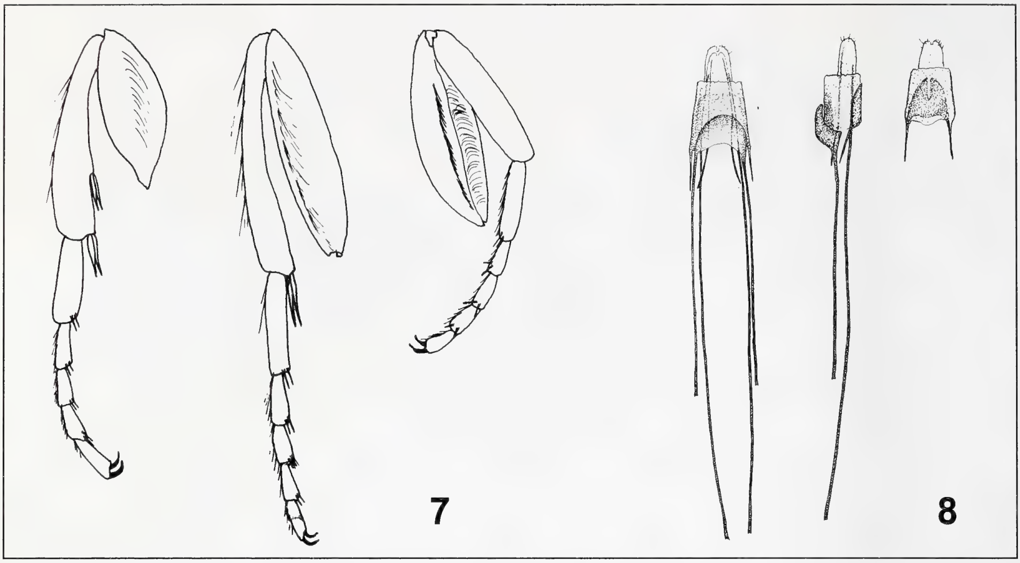

Abb. 7–8. *Kalliesia irana* sp. n., ♀. **7.** Vorder- (rechts), Mittel- (Mitte) und Hinterbein (links) (Gesamtlänge Vorderbein 1,2 mm). **8.** Genital, Länge 4,7 mm.

Beschreibung ♂. Kopf. Komplexaugen rund, keine Ocellen; kleinster Augenabstand geringer Augendurchmesser. Vertex mit abstehenden hell weißlichbraunen, meist zweispitzigen, Frons mit abstehenden, hellbraunen mehrspitzigen Schuppen besetzt. Labialpalpen deutlich ausgeprägt, dreigliedrig, dicht braun beschuppt.
Fühler. 29 Glieder (inklusive Scapus, Pedicellus und Fühlerendglied), Kammzähne im Bereich des 7.–14. Fühlergliedes größte Länge erreichend, Verhältnis Kammzahn zu Fühlerglied 4:1. Fühlerglieder hell und dunkel beschuppt, Kammzahnpaare mit Saetae besetzt.
Thorax. Mit hellbraunen Schuppen bedeckt. Vordertibien mit Epiphyse (etwa 2/3 Länge Tibia).
Flügel. Vorderflügel dicht hellbraun beschuppt, Schuppenklasse 5 und 6 (vgl. Sauter 1956), mit dunklen Schuppen durchmischt, undeutliche, schwache Gitterung. Am distalen Teil der Costa vier undeutliche kleine dunkle Flecken, Termen dunkler, Fransen lanzettförmig, breit, heller als Flügelfärbung. Hinterflügel einfarbig, etwas dunkler als Vorderflügel. Lanzettförmige Schuppen des Saumes mehrspitzig. Die Flügeläderung beider Exemplare stimmt mit der Urbeschreibung überein. M2+M3 der Hinterflügel sind gemeinsam gestielt.
Bemerkungen. Amsel (1955) verweist nicht auf die bei beiden Faltern gut ausgeprägte eingeschobene Zelle in der DZ der Vorderflügel, die der Gattung *Eochorica* fehlt und diese von *Typhonia* unterscheidet. Die Untersuchung des Genitalpräparates ergab zusätzlich das Vorhandensein eines kleinen Dornes auf jeder Seite des tief eingebuchteten Tegumenhinterrandes (Abb. 13). Im Ergebnis der Untersuchung ist der Transfer aus der Gattung *Eochorica* notwendig: *Typhonia troughti* comb. n. Die Untersuchung der Falter und der Genitalstrukturen sowie die Nähe zum Typenfundort

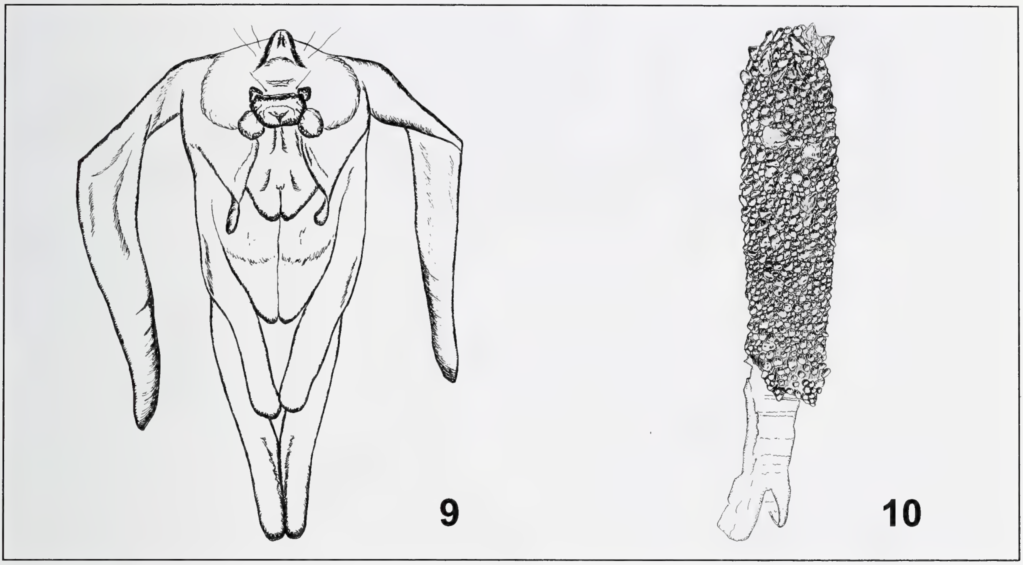

Abb. 9–10. *Kalliesia irana* sp. n., Puppenstadium. **9.** Exuvie, Frontalansicht des Kopf- und Thoraxbereiches (Maximalausdehnung Dorsal–Ventral Länge 1,5 mm). **10.** Sack mit Exuvie, ♂ (Sacklänge 11,0 mm).

von *Typhonia paulusella* (Caradja, 1921) legten den Verdacht der Identität mit dieser Art nahe. Die von Hättenschwiler (1990) untersuchten und abgebildeten Genitalstrukturen von *T. paulusella* weisen weitgehende Übereinstimmung mit *T. troughti* auf.

Der Holotypus von *T. paulusella* befindet sich im Museum „Grigore Antipa“ in Bukarest. Eine Ausleihe war nicht möglich. Dr. Mihai Stanescu, Bukarest übermittelte Daten und Fotos vom Holotypus und dem dazugehörigen Sack. Nach diesen Informationen konnte die Gattungszugehörigkeit von *T. paulusella* nicht geprüft werden. Nach der Beschreibung (Caradja 1920) und den vorliegenden Ergebnissen kann jedoch ausgeschlossen werden, dass *T. troughti* mit *T. paulusella* conspezifisch sind. Die Zeichnung von *T. paulusella* ist deutlich intensiver und ausgeprägter. Eine im äußeren Flügeldrittel parallel zum Saum verlaufende fast gerade braune Binde charakterisiert *T. paulusella* und unterscheidet sie von *T. troughti*.

6. Diskussion

Sauter & Hättenschwiler (1999) trennen in ihrem Bestimmungsschlüssel die Typhoniini insbesondere durch das Vorhandensein oder Fehlen von eingeschobenen Zellen und/ oder Anhangzellen in der DZ der Vorderflügel der Männchen. Dieser Merkmalskomplex ist bei *Kalliesia irana* (n=4) variabel und nicht zur Diagnose verwendbar. Von den Typhoniini wurden daraufhin *Dissoctena granigerella* Staudinger, 1859 (n=3), *Eudissoctena maurella* Rebel, 1934 (n=2), *Eudissoctena minorella* Rebel, 1934 (n=1) und *Eudissoctena minimella* Rebel, 1934 (n=8), *Eumelasina ardua* (Kozhanchikov, 1956) (n=1) und *Eumelasina pliginskii* (Kozhanchikov, 1956) (n=1),

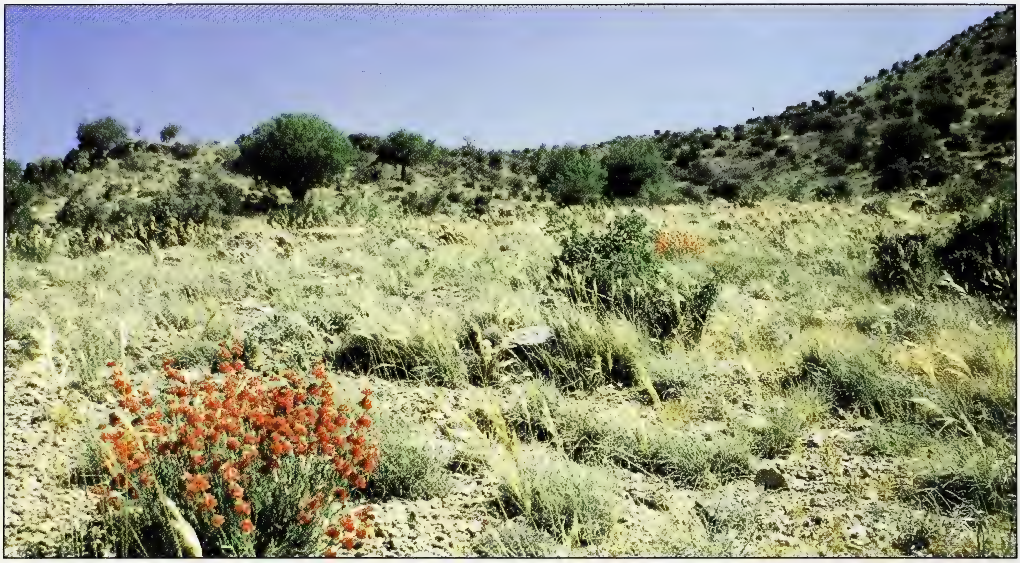

Abb. 11. Der Typenfundort von *Kalliesia irana* sp. n.: Iran, Provinz Boyer Ahmad-Va-Kohgiluyeh, Gardaneh Meymand, 2550 m (photo: A. Kallies).

Eochorica balcanica Rebel, 1919 (n=3), *Typhonia ciliaris* (Ochsenheimer, 1810) (n=4) sowie *Typhonia troughti* (Amsel, 1955) (n=2) untersucht und mit Literaturangaben (Amsel 1955; Hättenschwiler 2000; Kozhanchikov 1956; Rebel 1934, 1940) verglichen (untersuchtes Material in CTS, *T. troughti* in SMNK). Nur bei *Eudissoctena minimella* wurde eine starke Variabilität festgestellt. Sie betrifft die Anzahl der zusätzlichen Zellen in der DZ des Vorderflügel (0–2) sowie die Anzahl der DZ-Adern des Hinterflügels (5 oder 6). Bereits Rebel (1934) weist auf die Variabilität des Flügelgeäders der Hinterflügel bei dieser Art hin. Bei den anderen Arten wurde eine Variabilität nur in der Größe der jeweiligen Zellen und der Intensität der Sklerotisierung der Adern festgestellt. In Kombination mit anderen Merkmalen ist das Vorhandensein und/oder Fehlen der zusätzlichen Zellen in der DZ der Vorderflügel für diese Gattungen zur Diagnose geeignet.

Von *Melapsyche* lag kein Material zur Untersuchung vor. Die Beschreibung der Gattung erfolgte nach einem Männchen, welchem die Vorderbeine fehlen (Kozhanchikov 1956). Später (Kozhanchikov 1960) wird auf das Vorhandensein der Vorderbeinepiphyse hingewiesen. Im Bestimmungsschlüssel von Sauter & Hättenschwiler (1999) wird das Fehlen der Epiphyse der Vorderbeine als differenzierendes Merkmal aufgeführt. In Zolotuhin (1998) wird *Melapsyche alla* Zolotuhin & Prokovjev, 1998 beschrieben und *Typhonia korbi* (Rebel, 1906) in die Gattung *Melapsyche* Kozhanchikov, 1956 transferiert. Beide Arten weisen eine Epiphyse an den Vordertibien auf und sind geflügelt. Im Gegensatz zu *M. multivenosa* Kozhanchikov, 1956 mit angedeuteter eingeschobener Zelle, ohne Anhangzelle in DZ der Vorderflügel zeigt die Abbildung von *M. alla* keine eingeschobene Zelle und eine angedeutete Anhangzelle, in der DZ des Vorderflügels. Bei *Typhonia korbi* sind beide Zellen vorhanden (Abb. in Zolotuhin

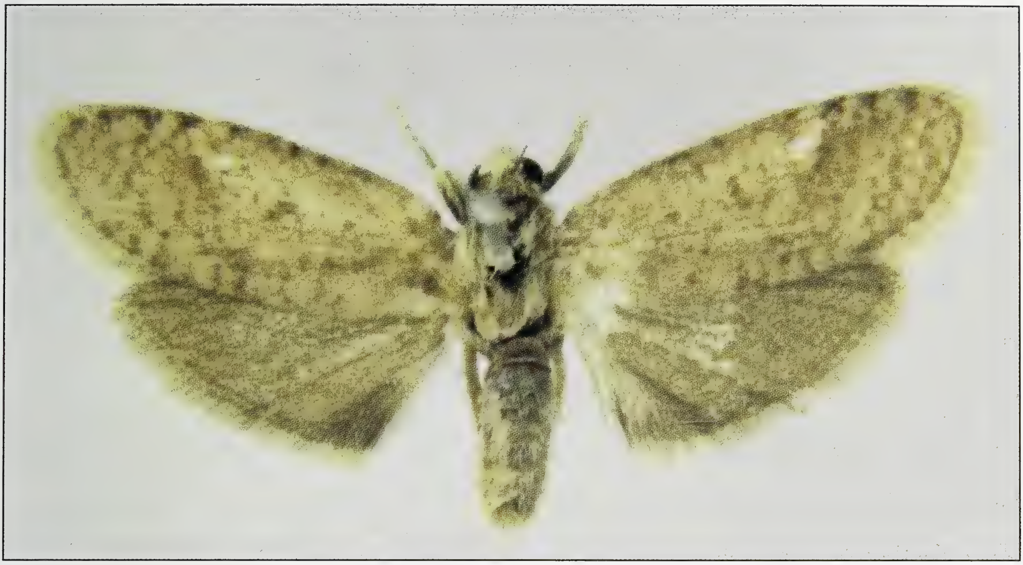

Abb. 12. *Typhonia troughti* (Amsel, 1955), Holotypus ♂, 18.x.1952, Jordan-Tal, Zerqa R. Colony, leg. Trought, coll. Amsel, SMNK

1998, 1♂ in ZSM untersucht). Die Autoren gehen nicht auf taxonomische Unterschiede von *Melapsyche* und *Typhonia* ein, der Transfer von *Typhonia korbi* zu *Melapsyche* ist unbegründet. Die als Differenzialmerkmal zu *M. alla* aufgeführte Äderung von *T. korbi* trifft auf *Typhonia* zu. Die diagnostischen Merkmale, die für *Melapsyche* und *Typhonia* gegeben werden, beziehen sich somit lediglich auf die variable Ausprägung der Anhang- und eingeschobenen Zelle in der DZ der Vorderflügel (wie sie bei *Kalliesia irana* gen. n., sp. n. und *Eudissoctena minimella* ebenfalls auftreten) und die kurz gestielten Adern M2+M3 im Hinterflügel (bei *Typhonia* meist getrennt, vereinzelt aus einem Punkt oder selten kurz gestielt). Diese Merkmale werden hier als nicht konstant und nicht ausreichend zur Aufrechterhaltung der Gattung *Melapsyche* betrachtet. *Melapsyche* syn. n. wird daher als jüngeres Synonym von *Typhonia* angesehen.

7. Bestimmungsschlüssel der Gattungen der Typhoniini

Männchen

–	Hfl. mit 5 DZ-Adern (beachte *Eudissoctena minimella* mit 5 oder 6)	**1**
–	Hfl. mit 6 DZ-Adern	**2**
1	Vordertibia ohne Epiphyse, Augenabstand kleiner als Augenhöhe, 22–24 Fühlerglieder	***Dissoctena***
–	Vordertibia mit Epiphyse, Augenabstand größer als Augenhöhe, 20–22 Fühlerglieder, Hfl.-Adern ungestielt	***Kalliesia***
2	Augen groß, Abstand kleiner als Augenhöhe, 30–35 Fühlerglieder	***Eochorica***
–	Augen klein, Abstand größer als Augenhöhe	**3**

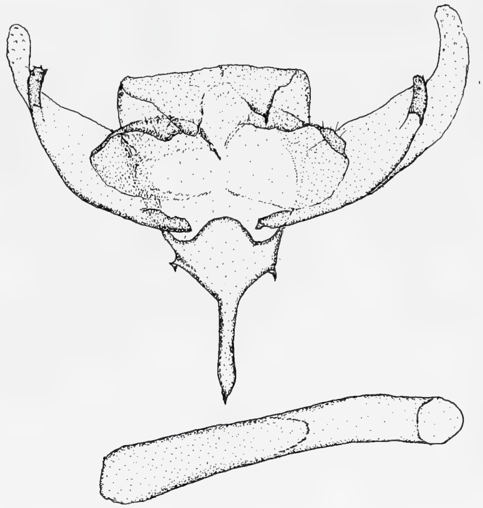

Abb. 13. *Typhonia troughti* Amsel, 1955, Genital ♂.

3 keine eingeschobene Zelle in DZ der Vfl., Aedeagus stark gebogen, 26–30 Fühlerglieder **Eumelasina**

– meist Anhangzelle und eingeschobene Zelle in DZ der Vfl. ausgeprägt, Aedeagus gerade oder schwach gekrümmt 4

4 Hfl. M2+M3 meist gestielt, Vfl. gegittert oder bestäubt, 20–25 Fühlerglieder **Eudissoctena**

– Hfl. meist M2+M3 ungestielt, Körper robust, (26–) 30–44 Fühlerglieder ***Typhonia*** (= *Melapsyche*)

Weibchen

– geflügelt ***Typhonia*** (= *Melapsyche*)

– flügellos oder mit kleinen Flügelstummeln 2

2 Hintertibien spornenlos 3

– Hintertibien bespornt 4

3 Labialpalpen fehlend, 12–18 Fühlerglieder, dicht behaart ***Eudissoctena***

– Labialpalpen, reduziert, deutlich sichtbar, 22–24 Fühlerglieder ***Dissoctena***

4 Hintertibien mit einem Spornenpaar 5

– Hintertibien mit 2 Spornenpaaren, 15–18 Fühlerglieder, Afterwolle cremefarben ***Kalliesia***

5 20–24 Fühlerglieder, Afterwolle cremefarben ***Eumelasina***

– 28–30 Fühlerglieder, Afterwolle braun ***Eochorica***

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Ich danke Peter Hättenschwiler (Uster, Schweiz), Axel Kallies (Melbourne, Australien) und Matthias Nuß (Dresden) für die vielfältige Unterstützung und Diskussion. Robert Trusch (SMNK) danke ich für die Zusendung der Typen von *T. troughti*, Mihai Stanescu (Bukarest) für die wertvollen Hinweise und Fotos zu *T. paulusella*. Rolf Bläsius (Eppelheim) danke ich für das Zuchtmaterial von *Eudissoctena maurella* und *E. minimella*.

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Blastodacna libanotica Diakonoff, 1939 – a pest on pear in Turkey (Agonoxenidae)

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Abstract. *Blastodacna libanotica* Diakonoff, 1939 (Agonoxenidae) is recorded for the first time to damage pear trees (*Pyrus* sp.) during the larval stage. The observation has been made in Oltu, district of Erzurum province (Turkey). The larvae make galls in the young shoots. Small trees do not survive heavy infestation with this pest. The biology is discussed and the external characters of the moth and the male and female genitalia, as well as the immature stages, are illustrated.

Key words. *Blastodacna*, Agonoxenidae, life history, taxonomy, pest species, Pyrus, Turkey, Palaearctic.

Introduction

Moths (Lepidoptera) can have an enormous impact on agriculture, forestry and stored products. Many species can cause severe damage to fruit and crops. For example, in the family Tineidae, the larvae of the clothes moths *Trichophaga tapetzella* (Linnaeus, 1758) and *Tineola bisselliella* (Hummel, 1823) are well known to feed indoors on manufactured goods of animal origin such as wool and hair. In the family Oecophoridae the larvae of *Hofmannophila pseudospretella* (Stainton, 1849) and *Endrosis sarcitrella* (Linnaeus, 1758) feed on dead animal and vegetable matter, and can be harmful to stored products and museum collections. In the Pyralidae the species of *Ephestia* Guenée, 1845 and *Cadra* Walker, 1864 are notorious for the damage to stored products; and several other species of the subfamily Phycitinae can be harmful to fruit and coniferous trees (Baker 1983). However, the largest group of species that can influence our way of life belong to the Tortricidae. More than 400 species of this family attack crops and fruit or cause severe damage to deciduous and coniferous trees (van der Geest & Evenhuis 1991). In the rather small family Agonoxenidae, *Haplochrois theae* (Kusnetsov, 1915) is a serious pest of the tea plant. The genus *Blastodacna* Wocke, 1876 belongs to the same family, and *Blastodacna atra* (Haworth, 1828) has been reported as a pest on apple (*Malus* sp.) (Miles 1930; Balachowsky 1934). The larvae of *Blastodacna*, from the few species of which the immature stages have been described, live in twigs or fruits of woody Rosaceae. Pupation takes place in a cocoon in the feeding place or in crevices of the bark of the food plant. The genus has a Holarctic distribution, but most species have been described from the Palaearctic region. Here we report for the first time damage caused by a second species of that genus, *B. libanotica* Diakonoff, 1939 on pear and wild pear.

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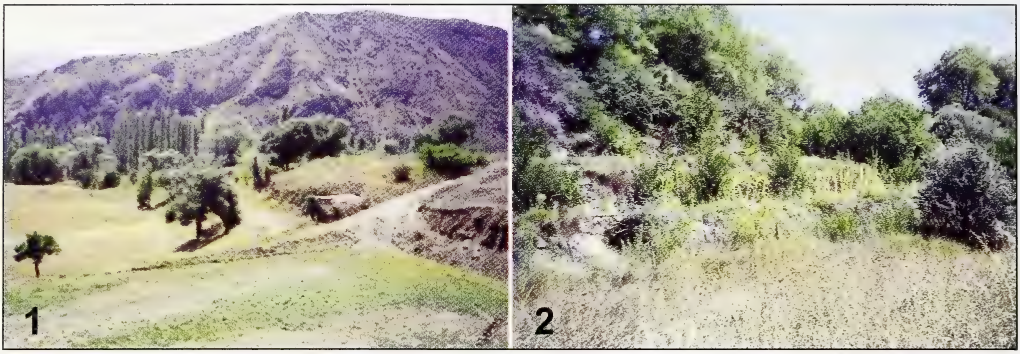


Figs. 1–2. Habitat of *Blastodacna libanotica* (photos H. Özbek). **1.** Turkey: Province of Erzurum near Oltu. **2.** Habitat in detail showing wild pear trees.

Material and Methods

Galls caused by *B. libanotica* were first found in August 2001 on the twigs of wild pear (*Pyrus elaegrifolia*) on a roadside 4 km west of Oltu, in the province of Erzurum, Turkey (Figs. 1, 2). The city of Oltu is located near a tributary of the Coruh River. The observations were made along a narrow valley, starting from an altitude of 2000 m and descending to 700 m over a distance of more than 100 km. Pear plantations can be found in this valley from the Black Sea coast up to 1400 m altitude. Although wild pear trees are abundant up to 2200 m, infested trees were only found up to 1600 m; trees higher up than this showed no infestation. Between 1000–1400 m cultivated pear trees are not very abundant, but wild pear trees are more common. Below 1000 m there are many orchards growing apple, pear and other fruit in mixed orchards. In the summer of 2003 a survey was conducted to detect the presence of this insect along the valleys of Uzundere, Tortum and Ispir which are fruit-growing areas. It was found that the trees in these locations were also infested with this pest, but the population density was very low compared with that in Oltu. Both cultivated and wild pear trees are infested, but small wild pears much more heavily so than bigger trees. The damage caused by this pest resulted in the death of several small wild pear trees.

2♀ and 4♂ of *B. libanotica* have been reared from Turkey, Erzurum, Oltu-Subatik, 1300 m, 4–12.iii.2002, leg. H. Özbek. The immature stages of this species have not been depicted before. Detailed pictures of the larvae and pupae were prepared with a SEM operated by Twan Rutten. For SEM observations, larvae and pupae were dehydrated in an ethanol series of 50%, 70%, 90% and 100% (2x), each step lasting at least 15 minutes. Samples were then critical point dried in a Bal-Tec CPD030 critical point dryer (Bal-Tec Ag, Liechtenstein). Dried samples were attached to an aluminium sample block and gold coated in an Edwards S150B sputter coater (Edwards high vacuum inc., Crawley, West Sussex, UK). Examination of the specimens and digital recordings were made in a Hitachi S4100 SEM (Hisco Europe, Ratingen, Germany) and saved as tif-files. Due to the dimensions of larvae and pupae, several recordings were required to produce overview images. The complete picture was obtained by subsequent editing in Photoshop 6.0.

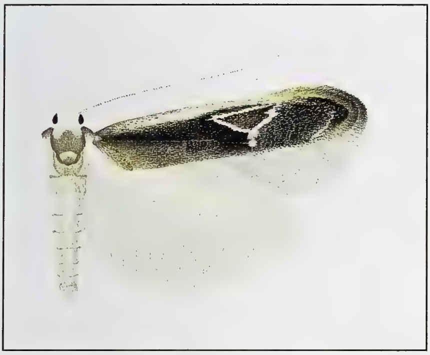


Fig. 3. *Blastodacna libanotica* Diakonoff, ♀ (watercolour J. C. Koster).

Blastodacna libanotica Diakonoff, 1939

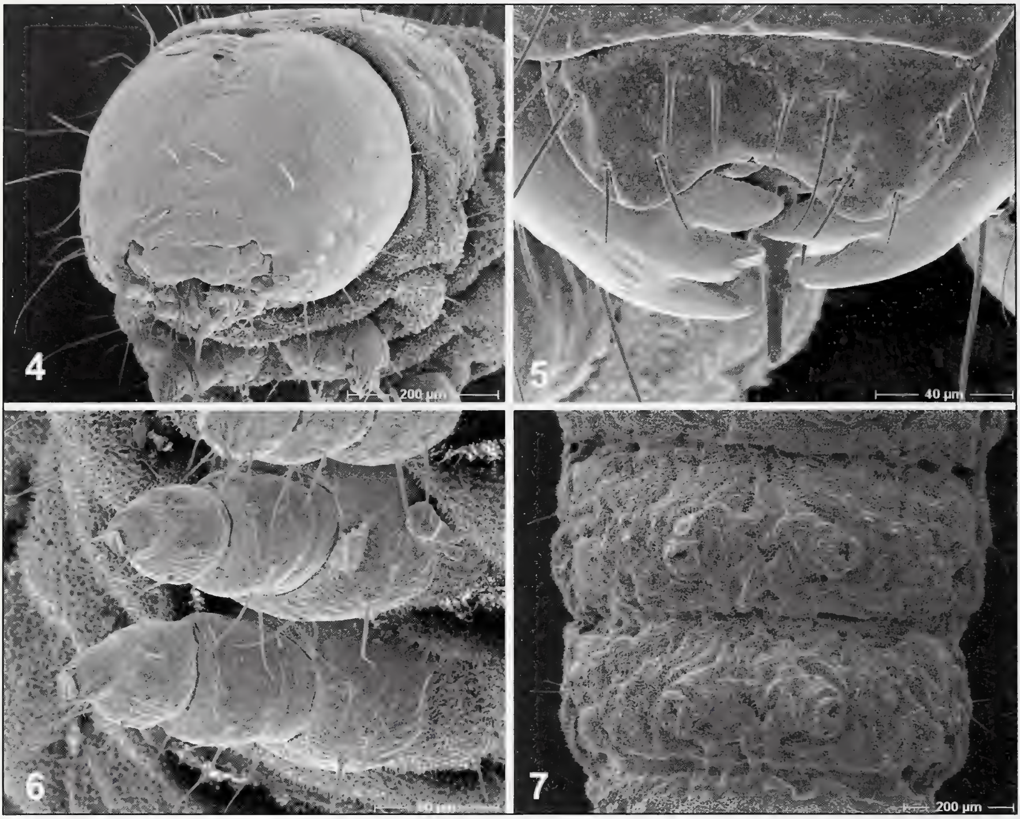
Diagnosis. The species of the genus *Blastodacna* are small moths with a wingspan mainly of 9–15 mm, and have dark forewings with rather conspicuous tufts of raised scales. *Blastodacna libanotica* (Fig. 3) can be distinguished from the other species in Europe and adjacent areas by the rather large wingspan, 14–15 mm, and by the forewing which has a white costal streak and a white-outlined triangular mark beyond the middle. For more detailed descriptions of the adults and the male and female genitalia of *Blastodacna* species from the western Palaearctic region see Koster & Sinev (2003). From the four species of *Blastodacna* known from the eastern Palaearctic region, *B. pyrigalla* (Yang, 1977), known from China and Korea, is very closely related to *B. libanotica* or possibly even conspecific.

Description of immature stages. Ovum. Light brown (Talhouk 1948). This author describes the eggs as light brown, but his observation is from shrunken eggs in a rearing case which never hatched. In comparison with other species of *Blastodacna,* the eggs of *B. atra* and *B. hellerella* are translucent white, later they become opaque and yellowish, and finally brownish (Miles 1930, 1932).

Larva. Rather short and fat. Head dark brown with six conspicuous whitish ocelli on each side in an oval grouping (Fig. 4); mandibles (Fig. 5) light brown; frontoclypeus whitish. Prothoracic plate dark brown, mixed whitish and divided dorsally; anal plate small, dark brown. Thoracic legs (Fig. 6) laterally with a dark brown posterior band on each segment. Abdomen bone-white; abdominal prolegs (Fig. 7) and anal prolegs (Fig. 8) whitish, a dark brown band above both anal prolegs. Length 5.5–6.5 mm. The larvae of *B. atra* and *B. hellerella* vary from greyish white to brownish pink, are more slender and have longer setae (Miles 1930, 1932).

Pupa (Figs. 9–11). Pale brown, anterior and posterior parts darker. Length 5.5–6 mm. Wing sheaths rather short, reaching halfway along abdominal segment six. This is in contrast with *B. atra*, where the wing sheaths almost reach the end of the abdomen (Réal 1966). Ventrally on the combined ninth and tenth segment are two long leg-like protrusions at an angle of 30°–60° with the abdomen (Fig. 12). Anteriorly they are densely covered with hooked setae (Fig. 13). Cremaster absent.

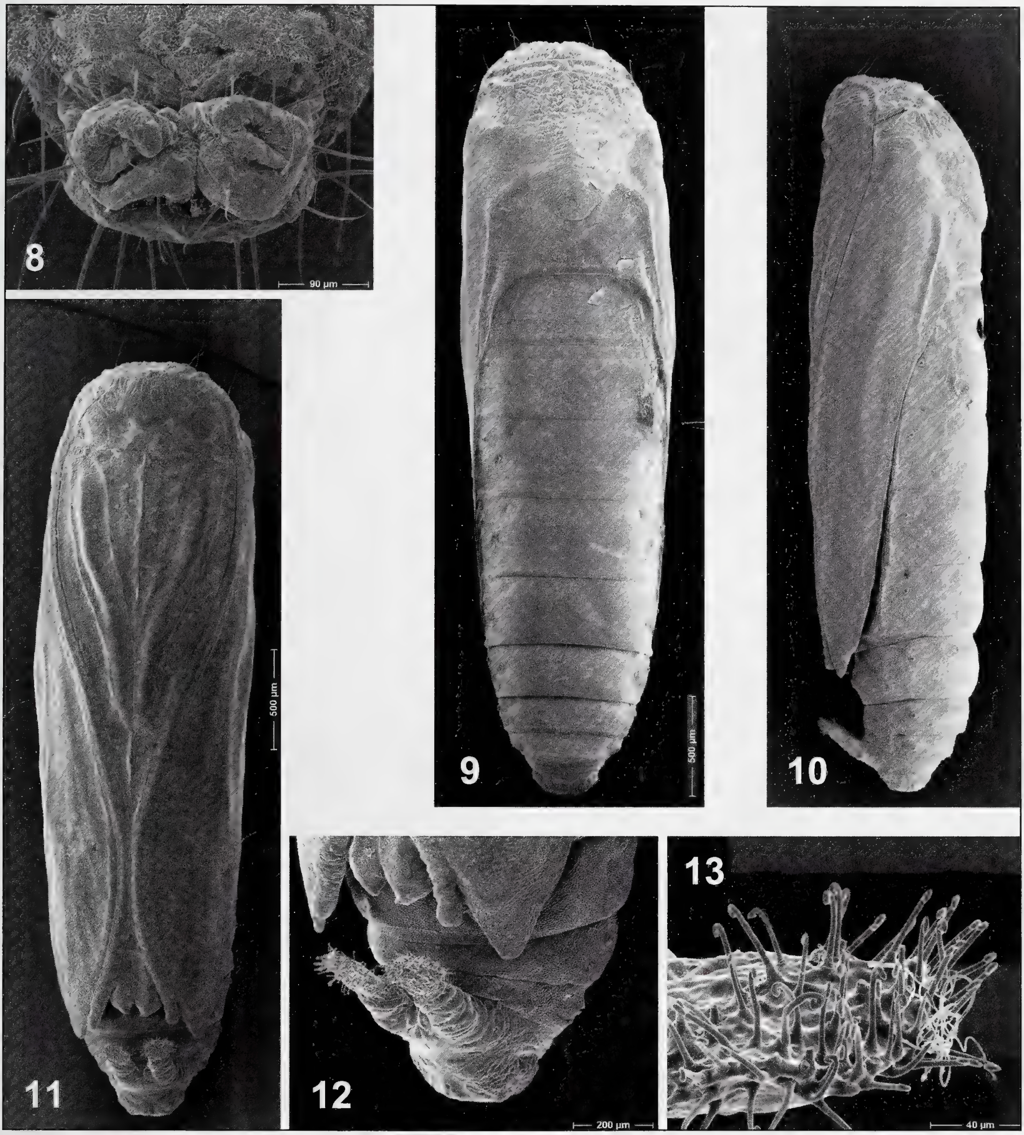
Life history. Oviposition takes place in spring. Despite several attempts, oviposition was not observed. *B. pyrigalla* lays its eggs around the base of the buds of *Pyrus* sp., and, after hatching, the young larvae move to a new twig and bore into the stem (Park 1986). The *B. libanotica* female also prefers to lay her eggs on new shoots. This was ascertained by attaching infected twigs to a small wild pear tree in early spring of 2002. A total of 33 galls were made by the larvae from those infected twigs. All but two of the galls were found in the young shoots. The remaining two were made in shoots of the previous year's growth.



Figs. 4–7. Features of the larva of *Blastodacna libanotica* Diakonoff (SEM photos by A.L.M. Rutten). **4.** Head of the larva (scale bar 200µm). **5.** Mouthparts of the larva showing the mandibles (scale bar 40 µm). **6.** Thoracic legs of the larva (scale bar 90 µm). **7.** Abdominal prolegs of the larva (scale bar 200 µm).

The larva makes a gallery in a thin twig in summer and early autumn. The gallery starts inwards at an angle of about 30° to the long axis of the twig, is then directed upward, later again in an angle of about 30° (Fig. 14). This activity causes the development of an elongate gall 11.5–13.5 mm in length and 7.3–8.6 mm in width. The gall is more or less constricted in the middle and with a rounded opening at the lower end (Fig. 15). Prior to pupation the larva enlarges the exit-hole and smoothes a circular area around its perimeter. Pupation takes place inside the gall at the end of autumn (Fig. 16).

There can be more than one gall in a twig. All exit-holes were also in the lower part of the galls, except in united galls (Fig. 17), but the polished circle around it was not always visible. From 15 July several galls were opened every two days to follow the process of the construction of the exit-holes and the stage towards pupation. On 15 July very small holes could already be observed by the extrusion of some grains of sawdust. Four days later they had been enlarged to maximum size. By 30 July all dissected galls contained larvae in the last instar, and after this date pupae were also



Figs. 8–13. Features of the pupa of *Blastodacna libanotica* Diakonoff (SEM photos by A.L.M. Rutten). **8.** Anal prolegs of the larva (scale bar 90 µm). **9.** Pupa in dorsal view (scale bar 500 µm). **10.** Pupa in lateral view (scale bar 500 µm). **11.** Pupa in ventral view (scale bar 500 µm). **12.** Leg-like protrusions at posterior end of pupa (scale bar 200 µm). **13.** Hooked setae on the leg-like protrusions with remains of silk of the cocoon (scale bar 40 µm).

found. On 10 September almost all of the dissected galls contained pupae. The larvae, as well as the pupae, were found with their heads directed towards the exit-holes. The larva constructs a cocoon in the lower part of the gallery in which the pupa hibernates. Both abdominal protrusions are firmly embedded into the silk of the cocoon, and hold the pupa in place during emergence of the adult.

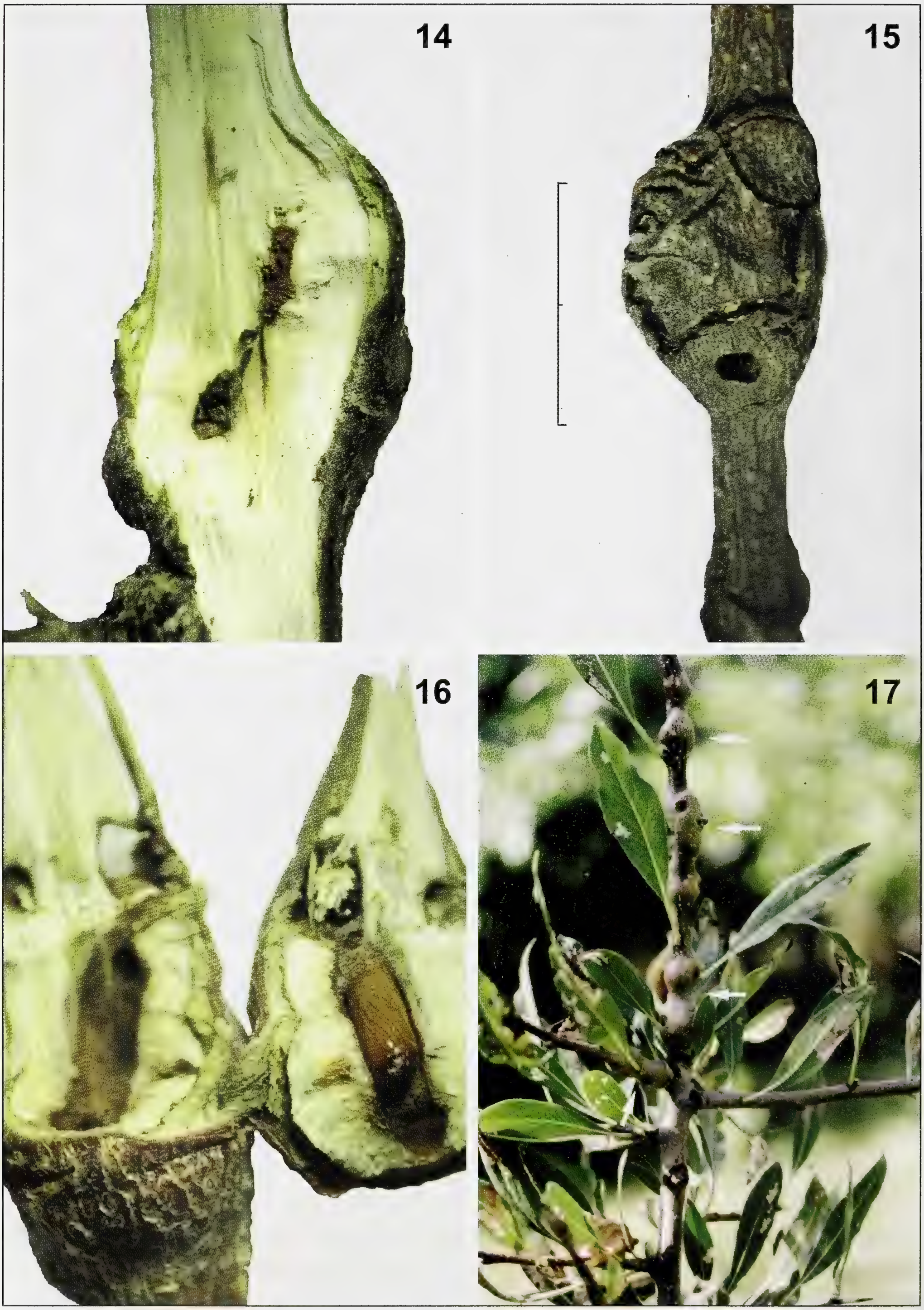


Fig. 14–17. Features of the galls of *Blastodacna libanotica* Diakonoff (photos H. Özbek). **14.** Longitudinal section of the gall with the upward part of the gallery. **15.** Gall with exit-hole (scale bar10 mm). **16.** Longitudinal section of the gall with the pupa, its head directed toward the exit-hole. **17.** Twigs with united galls.

Adults appeared from 25 April to 10 May. In Lebanon, emergence of the adults had already started in February and lasted until May. The later appearance of adults in Turkey is possibly due to different latitude and the higher altitude.

Host plant. *Pyrus* sp. (Rosaceae), but Talhouk (1948) also reported a few galls on hawthorn (*Crataegus* sp.). The hostplant of the sibling *B. pyrigalla* is also pear, but it has also been found on peach (*Prunus persica*) and persimmon (*Diospyros kaki*, Ebenaceae) (Park 1986).

Parasites. No parasites were found in the Turkish material. Talhouk (1948) mentioned the rearing of several specimens of Pimplinae (Hymenoptera: Ichneumonidae) from distorted galls, later reported as belonging to the genus *Lissonota* Gravenhorst, 1829 (Herting & Simmonds 1975).

Distribution. *B. libanotica* has been described from specimens reared from galls on pear found in Aley, Lebanon in 1933 (Diakonoff 1939). In 1938 and following years, galls were also found in Abaydieh, Lebanon (Talhouk 1948). The first record for Turkey was made by Koster & Sinev (2003), this with reference to a female specimen from Gebse, 50 km east of Istanbul, collected by Glaser in 1969. Some authors also mention Syria, referring to the original description (Diakonoff 1939), but in those days Lebanon was a part of Syria. It is remarkable that this species on wild and cultivated pear has so far only been recorded from Lebanon and eastern Turkey. Since it occurs as a pest on economically important plants, surveys should be conducted to determine possible infestation in other parts of the country, as well as in other Middle East countries.

Conclusion. *B. libanotica* is here shown to be a pest on wild and cultivated pear trees in Turkey for the first time. It can be regarded as a minor pest in the fruit growing area along the valleys of Oltu, Uzundere, Tortum, and Ispir. However, it has been observed that wild pear trees, particularly the small ones, were more attractive than the cultivated pear trees. Heavily infested branches of some wild pear trees were completely withered, which could cause the death of small trees. It is possible that infested wild pear trees will act as a reservoir of infestation for future pear plantations in these areas. When the main shoot of cultivated trees is infested, its growth is retarded and this induces an increased development of the lateral shoots.

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The *Eucosma hohenwartiana* group of species (Tortricidae)

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Abstract. The *Eucosma hohenwartiana* group of species is reviewed to take account of constant structural differences in the ovipositor of the females. Two taxa whose status has been in doubt are removed from synonymy with *E. hohenwartiana* ([Denis & Schiffermüller], 1775) and restored to full species rank: *E. fulvana* (Stephens, 1834) sp. rev. and *E. parvulana* (Wilkinson, 1859) sp. rev. [= *scutana* (Constant, 1893) syn. n.]. Their respective host plants are given. Lectotypes of *E. fulvana* and *E. parvulana* are designated.

Zusammenfassung. Die Arten der *Eucosma hohenwartiana* Gruppe werden revidiert und zwei Taxa von unsicherem Status werden auf Grund konstanter Unterschiede in der Struktur des Ovipositors der Weibchen von *E. hohenwartiana* ([Denis & Schiffermüller], 1775) getrennt und zu vollen Arten erhoben: *E. fulvana* (Stephens, 1834) sp. rev. und *E. parvulana* (Wilkinson, 1859) sp. rev. [= *scutana* (Constant, 1893) syn. n.]. Ihre Nahrungspflanzen werden angegeben und Lectotypen werden für *E. fulvana* und *E. parvulana* festgelegt.

Résumé. Ayant trouvé des différences constantes dans la structure de l'ovipositeur des femelles, les auteurs analyse le groupe d'espèces d'*Eucosma hohenwartiana* ([Denis & Schiffermüller], 1775). Deux taxons, dont le statut était douteux, sont de nouveau reconnus comme valides: *E. fulvana* (Stephens, 1834) sp. rev. et *E. parvulana* (Wilkinson, 1859) sp. rev. [= *scutana* (Constant, 1893) syn. n.]. On mentionne leurs plantes-hôtes respectives et on désigne lectotypes pour *E. fulvana* et *E. parvulana*.

Key words. Lepidoptera, Tortricidae, *Eucosma*, *hohenwartiana*, species group.

Introduction

The *Eucosma hohenwartiana* group of species comprises three taxa whose status has long been in question. The species described as *E. parvulana* (Wilkinson, 1859) has been treated in Britain as a form of *E. hohenwartiana* ([Denis & Schiffermüller], 1775) although in continental Europe it has retained specific status under the name *E. scutana* (Constant, 1893). *E. fulvana* (Stephens, 1834) has most often been treated as a form of *E. hohenwartiana* but not all authors have accepted this (e.g. Novák & Liška 1997). We will demonstrate that the three are distinct species. *E. hohenwartiana* itself is not in dispute, although in the past it was often confused with *E. cana* (Haworth, 1811). All are now accepted as belonging to the genus *Eucosma* Hübner, 1923, but in the past they have been assigned to various genera.

Wilkinson (1859) was first to recognise the three species of the group with which this paper is concerned: *E. scopoliana* (Haworth, 1811), *E. fulvana* (Stephens) and *E. parvulana* Wilkinson. His information on life history was not very precise. The name *E. scopoliana*, which he used for *E. hohenwartiana,* is not available since it is a junior homonym of *Tortrix scopoliana* [Denis & Schiffermüller], 1775.

Meyrick (1895) and Barrett (1907) placed *E. parvulana* as synonym of *E. scopoliana* for which species they gave *Centaurea nigra* as the host plant, although *E. parvulana,* treated by Barrett as a form, was said to swarm around *Serratula tinctoria,* whilst *Centaurea scabiosa* was given as the host plant of *E. fulvana* (treated as a species).

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Meyrick (1928) introduced the generic name *Eucosma* but other information remained the same.

Spuler (1907: 281) described *E. scopoliana*, under which he refers to "Die englische *v. parvulana* Wlk.", on *Cirsium, Carduus, Centaurea* and *Picris*. He recorded *E. fulvana* from *Centaurea iacea* and *C. lanceolatum*, and he also listed *E. scutana*.

Bradley (1959) introduced the name *E. hohenwartiana* in place of *E. scopoliana*, and under that name listed f. scopoliana and f. parvulana. Confusion in the past concerning the use of the name *E. hohenwartiana* was summarised by Barrett (1873) although this was chiefly confusion with *E. cana*.

Hannemann (1961) gave the same three species: *E. hohenwartiana* on *Centaurea, Carduus,* and *Cirsium, E. fulvana* on *Picris hieracioides* (but this was a misidentification of *E. balatonana* Osthelder), *Centaurea* and *Cirsium*, and *E. scutana* on *Serratula tinctoria.* He also illustrated the male genitalia.

Von Schantz (1962) regarded *E. fulvana* and *E. hohenwartiana* as separate species although stating that continental forms cannot always be distinguished from each other, whereas in England the two forms are quite distinct in colour and wing markings. He also gave differences in the genitalia, especially the females, which agree largely with our findings; however he illustrated the comparison only between *E. hohenwartiana* and *E. cana*. He did not mention *E. parvulana* nor its host plant *Serratula tinctoria.*

Opheim (1967) considered *E. fulvana* and *E. parvulana* to be merely British forms of *E. hohenwartiana*. He made many measurements of the valvae of the males showing a wide range of variation and based his opinion of the females largely upon the relative size of the two signa.

Bentinck & Diakonoff (1968) recognised *E. hohenwartian* and *E. fulvana,* illustrating the genitalia of both sexes and describing differences.

Bradley (in Kloet & Hincks 1972) indicated that the status of *E. fulvana* was doubtful. This was taken further by Bradley et al. (1979) when all three taxa were regarded as one species with *E. parvulana* and *E. fulvana* given as forms. They say of *E. fulvana*: "...which has usually been considered to be a separate species. However, as no tangible morphological difference can be found to separate *fulvana* from *hohenwartiana*, and superficially the two forms intergrade, they are treated here as one species." *Centaurea nigra, C. scabiosa* and *Serratula tinctoria* were given together as host plants. Emmet (1979), although drawing largely on the manuscript of Bradley *et al.* (*loc. cit.*), was clearly unhappy about this and he gave *E. fulvana* as a distinct species feeding on *Centaurea scabiosa* with the comment "Possibly only a form of the preceding species (*hohenwartiana*)". It is no surprise to find that Bradley & Fletcher (1979) and Bradley (1998, 2000) maintain the same position as Bradley et al. (1979), with *E. fulvana* listed as a form of *E. hohenwartiana.*

Kuznetsov (1989) listed the same species and host plants, illustrated the male genitalia, and provided a key to both external features and genitalia. Razowski (2001) briefly described just *E. hohenwartiana* and *E. scutana,* mentioning *E. fulvana* as an infrasubspecific form, citing Bradley as authority for that status. Recent checklists of countries in continental Europe vary in their treatment of the taxa *E. hohenwartiana*

and *E. fulvana*. Thus Karsholt & Razowski (1996), whilst listing the taxa separately, state that most authors regard *E. fulvana* as a form of *E. hohenwartiana*.
It was Razowski's (2001) illustration, together with the information about *E. scutana* feeding on *Serratula tinctoria,* that led us to ask whether this might be the same taxon as *E. parvulana*. Accordingly we set about obtaining more material and making genitalia preparations. Although not reared from larvae, our specimens were all taken on or near their respective host plants cited below.

Methods

Genitalia preparations were made of all three taxa from British specimens in our private collections, and a male and female of *E. scutana* from southern France in the collections of The Natural History Museum, London (BMNH), and of the lectotypes (designated below) of *E. fulvana* and *E. parvulana*. Further specimens and genitalia preparations on loan from Copenhagen (ZMUC) and Vienna (NMW) were examined, and a specimen of *E. scutana* from the Staudinger collection in Berlin, which he had received in exchange from Constant. The structures of the ovipositor of the females were measured using a scale in the microscope eyepiece and the specimens were identified, initially, only by the slide number. These measurements were arranged according to the length of the apophyses posteriores. In all we examined 23 females from Britain, and 28 from continental Europe. The lengths measured are shown in Fig. 1.

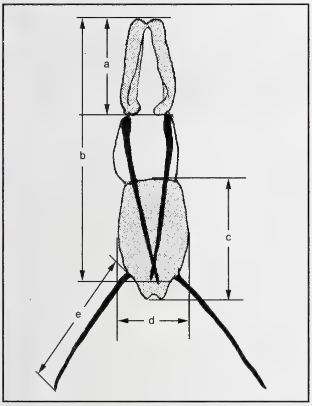


Fig. 1. Diagram showing ovipositor and measurements taken. **a.** The papillae anales (ovipositor pads). **b.** The posterior tip of the ovipositor to the anterior end of the apophyses posteriores. **c.** The length of the sclerotised plate of the 8th abdominal segment. **d.** The width of the 8th abdominal segment. **e.** The length of the apophyses anteriores.

Results

We found that the three taxa were clearly distinct. There appeared to be constant differences between the female genitalia of *E. parvulana* and *E. hohenwartiana*. The eighth segment of *E. hohenwartiana* was longer and narrower than the other two species and its ovipositor was also longer. Examination of specimens of *E. fulvana* showed that the female genitalia also differed from *E. hohenwartiana*, even though they were very similar to those of *E. parvulana*, except in size. Continental specimens showed similar differences to British specimens in the genitalia, but were not so easily separated on wing pattern and colour.

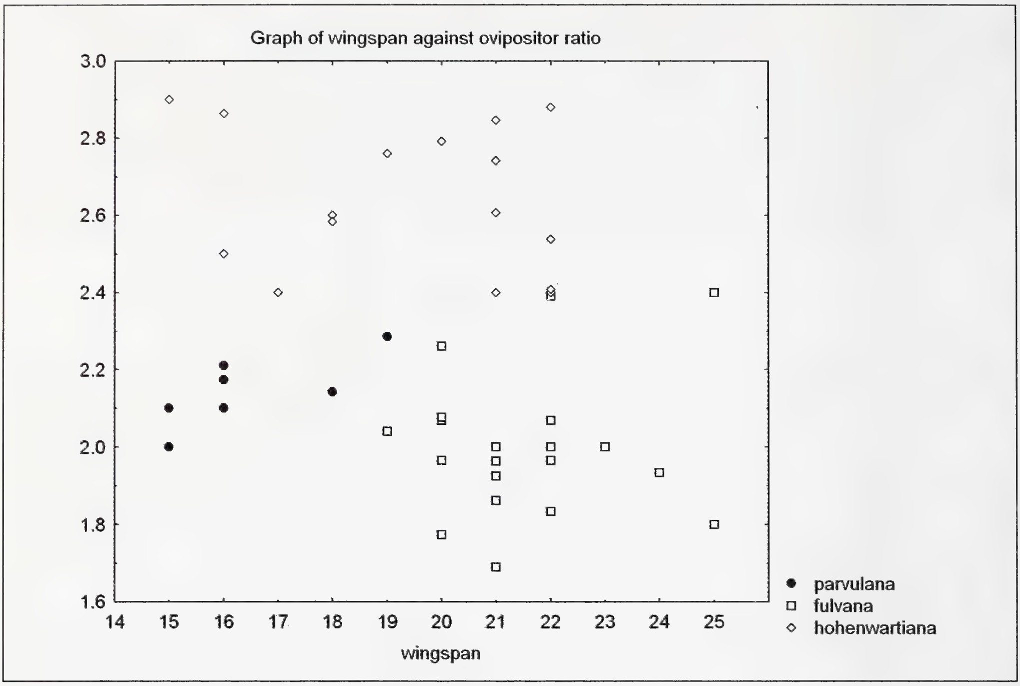


Fig. 2. Scatter diagram showing ratio of ovipositor to papillae (b/a) plotted against wingspan.

The results are shown in the scatter plot, Fig. 2, where the ratio of ovipositor length to papillae (b/a) is plotted against wingspan. All measurements are given in mm. It is therefore usually possible to separate the taxa as follows:

1 Ratio of ovipositor (including apophyses posteriores) to papillae anales (b/a) > 2.4 ***E. hohenwartiana***
Ratio of ovipositor (including apophyses posteriores) to papillae anales (b/a) < 2.4 **2**
2 Wingspan > 19.5mm, apophyses posteriores + ovipositor (b) > 1mm ***E. fulvana***
Wingspan < 19.5mm, apophyses posteriores + ovipositor (b) < 1mm ***E. parvulana***

In cases where there is still doubt examination of the eighth segment should settle the determination. The differences in the size of the eighth abdominal segment are less easily measured, as each width (d) varies according to the arrangement of the preparation. However, the mean values of the length (c) of the sclerotised part of the segment in the specimens studied were *E. hohenwartiana* 0.57mm, *E. fulvana* 0.49mm and *E. parvulana* 0.39mm. There was slight overlap between the range of measurements of *E. hohenwartiana* and *E. fulvana*. Von Schantz (1962) stated that the projections at the anterior end of this segment (which he calls 'chitinplatte') are pointed inwards towards each other. We have not found this to be the case, although these projections are usually longer and more pointed in *E. hohenwartiana.*
Kuznetsov (1990), Hannemann (1961), von Schantz (1962), Bentinck & Diakonoff (1968) and Chambon (1999) illustrate and describe differences in the male genitalia, but Opheim (1967) points out that such a range of differences can occur within one species.

We have detected differences in the socii and uncus, as well as variation in the valvae, but no one character or combination of characters can be relied upon to separate the species. Since there are constant structural differences between the females of the three taxa, there are differences in size and wing-coloration and the host plants are distinct, we restore specific status to each of them. In his description of *E. scutana,* Constant (1893) gave the differences he saw between *E. scutana* and *E. parvulana.* We have considered these and although there are very slight differences in the wing pattern these do not, in our opinion, justify specific status. Therefore *E. parvulana* is raised from the synonymy of *E. hohenwartiana* and becomes the senior synonym for *E. scutana.* Barrett (1907) stated that small specimens of *E. hohenwartiana* are found everywhere with typical ones and he thought these the same as *E. parvulana.* We have included such specimens in our dataset and they are clearly nothing other than small specimens of *E. hohenwartiana*, having the comparatively long ovipositor which *E. parvulana* do not possess.

Eucosma hohenwartiana **([Denis & Schiffermüller], 1775)** **Figs. 3, 4, 5**

Phalaena Tortrix hohenwartiana [Denis & Schiffermüller], 1775: 129, No. 15.
Tortrix scopoliana Haworth, 1811: 456 [homonym].
Tortrix pupillana Hübner, [1796]: pl.4, fig. 20 [homonym].
Catoptria hohenwarthiana Guenée, 1845: 189. *misspelling.*
? *Semasia jaceana* Herrich-Schäffer, 1851: 248.

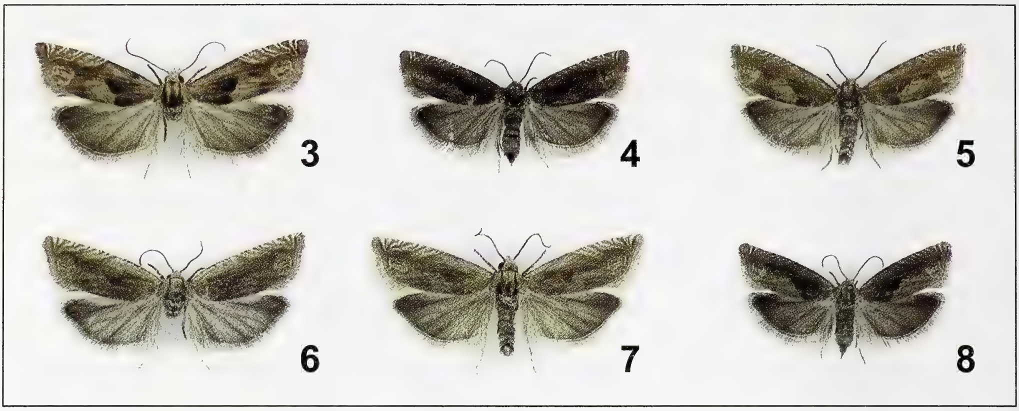
Description. Adult. Wingspan 15–22mm. This species is very variable in both size and wing pattern. The forewings are usually dark brown, often with contrasting markings, although paler more uniform specimens occur in continental Europe. In the female genitalia (Fig. 9) the ovipositor is long and slender. The apophyses posteriores are long and the eighth abdominal segment is also long.

Larva. Head pale to mid-brown, mouth parts and sutures dark brown. Prothoracic plate concolorous with head, mottled darker. Body pinkish ochreous to pink, minutely flecked whitish; anal plate concolorous, flecked pale brown; prolegs concolorous with body; thoracic legs translucent amber coloured. It feeds in flowers and developing seeds of *Centaurea nigra* in July and August; it then leaves the feeding place and hibernates fully fed in detritus on the ground. In continental Europe possibly on other *Centaurea* spp.

Remarks. *Eucosma jaceana* (Herrich-Schäffer) was treated by Hannemann (1961) as a distinct species, whilst Barrett (1873) and Kennel (1921) gave it as a synonym of *E. fulvana*. We have been unable to locate a type specimen but a specimen from the collection of O. Hofmann, who obtained many Microlepidoptera from the Herrich-Schäffer collection (Horn et al. 1990), was dissected and found to be identical to *E. hohenwartiana* even though the wing pattern was similar to *E. fulvana.*

Type material. The type specimens of *E. hohenwartiana* from Vienna have been destroyed (Horn & Kahle 1935). We would have liked to designate a neotype, but even with help from Austrian colleagues no specimen could be found which satisfied the conditions of paragraph 75.3.6 of the ICZN.

Distribution. Throughout Britain and Europe.



Figs. 3–8. Adults of the *Eucosma hohenwartiana* group of species (at constant scale). **3–5.** *E. hohenwartiana*. **6–7.** *E. fulvana*. **8.** *E. parvulana*.

Eucosma fulvana (Stephens, 1834) sp. rev. Figs. 6, 7

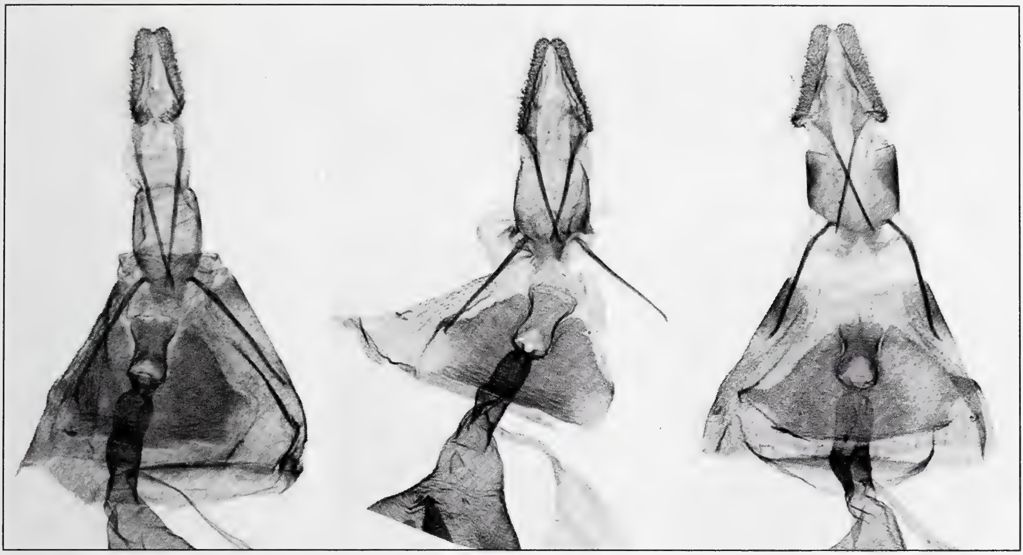
Carpocapsa fulvana, Stephens, 1834: 123.

Description. Adult. Wingspan 19–25mm. In Britain distinguished by its large size and fulvous coloration, paler than *hohenwartiana*. In the female genitalia (Fig. 11) the apophyses posteriores are short but the eighth segment is of moderate length.
Larva. Head pale brown, mouthparts and sutures dark brown. Prothoracic plate very pale honey coloured, translucent. Body creamy whitish to pink; anal plate concolorous with prothoracic plate, sparsely flecked dark brown; prolegs and thoracic legs concolorous with body. Feeds on *Centaurea scabiosa* in the same manner as the preceding species.
Type material. The species is described from the neighbourhood of London. A female specimen in the Stephens collection in the Natural History Museum, London bearing a type label is hereby designated as the lectotype. It is identified by a purple lectotype label, a label inscribed "Stephens Coll. | *Carpocapsa fulvana* Steph | Named by Steph." a label bearing the slide No. 30755 and a label "lectotype | *Carpocapsa fulvana* Stephens | det. D. Agassiz & J. Langmaid, 2003." This designation is made since the original publication did not specify the number of specimens.
Distribution. Widespread in Britain and Europe, but the exact distribution is unclear because of former confusion with *E. hohenwartiana*.

Eucosma parvulana (Wilkinson, 1859) sp. rev. Fig. 8

Catoptria parvulana Wilkinson, 1859: 91, pl. 1 fig. 6.
Grapholitha scutana Constant, 1893: 391, pl. 11 fig. 3, syn. n.

Description. Adult. Wingspan 14–19 mm. Distinguished by its small size, although small specimens of *E. hohenwartiana* also occur. The forewings are more uniformly coloured and strongly contrasted specimens, as often found amongst *E. hohenwartiana*, are not known. In the female genitalia (Fig. 10) the apophyses posteriores



Figs. 9–11. Ovipositors of the *Eucosma hohenwartiana* group of species (not to the same scale). **9.** *E. hohenwartiana.* **10.** *E. parvulana.* **11.** *E. fulvana.*

of *E. parvulana* are short, as is also the eighth abdominal segment. The ovipositors of the specimens from France named *E. scutana* which were examined fell entirely within the range of variation of *E. parvulana*.

Larva. Head amber coloured, mouthparts dark brown. Prothoracic plate colourless, translucent. Body pale pinkish ochreous; anal plate, prolegs and thoracic legs all concolorous with body. It feeds on *Serratula tinctoria* in the same manner as the preceding two species.

Type material. The species is described from the Isle of Wight. In the Hunterian Museum, Glasgow, there are two specimens, ♂ and ♀, from the Wilkinson collection. The ♀ No. 118973 is hereby designated the lectotype so that the taxon is clearly distinguishable by its type material, the specimen has a purple lectotype label, a label reading *"Catoptria parvulana* Wilkinson, 1859 | ex Wilkinson Colln | ?possible syntypes", and a label "LECTOTYPE | *Catoptria parvulana* Wilkinson | det. D. Agassiz & J. Langmaid 2003.

Distribution. In Britain recorded from South Hampshire and the Isle of Wight, in continental Europe from southern France and Germany eastwards through Italy and the Balkan states to Romania. Two specimens from Hövblege, Denmark, ♂ and ♀, were identified by Niels Wolff as *E. parvulana* and the female agrees with this species both in appearance and genitalia even though *Serratula tinctoria* is very rare. The species may be more widespread but recorded as *E. hohenwartiana.*

In continental Europe there are more *Centaurea* spp. than in Britain and the host range of some of these species may be wider. It is also unclear whether all the host plants listed in continental literature can be verified and further study to confirm the associations would be of interest.

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Book review

Günter Ebert (ed.) 2003. Die Schmetterlinge Baden-Württembergs, Band 9, Nachtfalter VII. (in German). – Eugen Ulmer, Stuttgart. 609 pp. – Hardback (ISBN 3-8001-3279-6) 49.90 € (final price may vary due to postage, taxes, and handling costs).

This is the ninth volume of a multi-author monograph series on the 'Macrolepidoptera' of Baden-Württemberg, the southwestern-most federal state of Germany. Although published in German, this book series has long been internationally accepted to set a new standard for faunal treatments of similar regional scope. The first two volumes of the series on butterflies, published in 1991, already have attained the status of a 'citation classic'. This new volume does not make an exception to the outstanding quality of its predecessors. Here the Geometridae are completed, with detailed accounts being given on 170 species (Larentiinae tribes Perizomini and Eupitheciini, plus subfamily Ennominae). Apart from the editor, 12 experienced German authors have contributed to the volume. The main emphasis of the book series is to provide detailed first-hand distributional and ecological data for all species that occur within the political boundaries of Baden-Württemberg. Accordingly, each species account summarizes the known distribution (globally and within the state, the latter also illustrated with detailed maps), the vertical distribution, and the phenology. Where data are available (e.g. for the *Eupithecia* species) phenology is graphically depicted for adult moths and larvae separately, or for various regions within the state of Baden-Württemberg (e.g. contrasting the upper Rhine valley with its mild climate to the montane Black Forest). Subsequently, information is given on habitat preferences, larval hostplants, nectar plants, behaviour, ecology and – where applicable – on special topics (debatable taxonomic status, unresolved ecological questions). Each species account ends with a scoring for the new Red Data List state-wide as well as for its subregions. All species are illustrated with one (rarely more) colour photographs of (mostly) live adult moths. In almost all cases also larvae or other early stages are figured, and quite often typical habitats are likewise illustrated. Yet, the books are not intended as identification guides. Only for groups where proper identifications are notoriously difficult to achieve, additional information is provided to facilitate determinations. In the present volume, this applies for example to the genus *Eupithecia*, for which colour plates of set specimens, drawings and SEM photographs of male and female genitalia, and extensive hints for identification are included. A very comprehensive references list (20 pages alone for the Geometridae) and useful indexes complete the work. This volume, and the entire series, has two major merits. First, all information presented has been most thoroughly cross-checked for reliability. Accordingly, only distributional or hostplant records that could really be verified are included. Along that way the endless perpetuation of erroneous records is interrupted – a most laudable approach, indeed. Second, the work summarizes as much information as possible for use in nature conservation, but also explicitly addresses many topics where further research is urgently needed. I have only two minor criticisms to this series. First, a brief English summary for each species (and perhaps English versions of table and figure legends and summaries of the more general chapters) would have greatly increased the utility of these fine books for an even broader international readership. Second, by the narrow focus on data collected in the federal state of Baden-Württemberg, considerable information was ignored which would otherwise have been available from neighbouring regions. However, in comparison with the impressive achievements by all volumes of this series, these minor deficits do not count much. Overall, I very strongly recommend this excellent source of information to everybody interested in the ecology, biogeography and conservation of moths (and butterflies) in central Europe. These books are not only densely packed with high quality scientific information – they are also beautiful to browse through and are absolutely worth their price.

KONRAD FIEDLER

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Three new species of Phycitinae from Central Asia (Pyraloidea: Pyralidae)

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Summary. The imago and male and female genitalia of *Myeloiodes minimella* gen. n. et sp. n. are described and illustrated. The imago and male genitalia of *Ocrisiodes turkmeniensis* sp. n. and *Prorophora* (*Prorophora*) *kazachstaniella* sp. n. are also described and illustrated. A diagnosis is given for *Myeloiodes* gen. n., *Ocrisiodes* Amsel, 1950, and *Prorophora* (*Prorophora*) Ragonot, 1887 and their wing venation are illustrated. The differences between *Myeloiodes* gen. n. and *Myelois* Hübner, 1825 are mentioned.

Zusammenfassung. *Myeloiodes minimella* gen. n. et sp. n. wird beschrieben und abgebildet zusammen mit den männlichen und weiblichen Genitalien. *Ocrisiodes turkmeniensis* sp. n. und *Prorophora* (*Prorophora*) *kazachstaniella* sp. n. werden beschrieben und zusammen mit den männlichen Genitalien abgebildet. Für *Myeloiodes* gen. n., *Ocrisiodes* Amsel, 1950 und *Prorophora* (*Prorophora*) Ragonot, 1887 wird eine Diagnose gegeben und das Flügelgeäder abgebildet. Die Unterschiede zwischen *Myeloiodes* gen. n. und *Myelois* Hübner, 1825 werden genannt.

Key words. Lepidoptera, Pyralidae, Phycitinae, new taxa, Central Asia.

Introduction

The subfamily Phycitinae is currently classified into four tribes, the Cryptoblabini, Phycitini, Cabniini, and Anerastiini (Roesler 1973, part 2: 43). A subtribe of the Phycitini is the Acrobasina, which is split into a quadrifid and a trifid group. The quadrifid group is characterised by the presence of veins m_2, m_3, cu_1 and cu_2 in the hindwing. In the trifid group, veins m_2 and m_3 of the hindwing are anastomosed (Roesler 1973). However, quadrifid and trifid species exist in all tribes, except Cabniini. This paper deals with phycitine species from Central Asia belonging to quadrifid and trifid Acrobasina. For the taxonomic study the genitalia were dissected according to Robinson (1976) and slides prepared using Euparal. Drawings of the genitalia were made with an Olympus microscope CHS with a drawing tube. The terminology of the wing venation follows Roesler (1973), while the remaining terminology follows Horak (1997).

Myeloiodes gen. n.

Type species: *Myeloiodes minimella* sp. n. (by monotypy)

Description. Head. Vertex covered with snow white, appressed scales extending beyond vertex. Ocelli present immediately behind scape of antennae. Chaetosemata present well behind scape near margin of eye. Patagia and tegulae white. Labial palps

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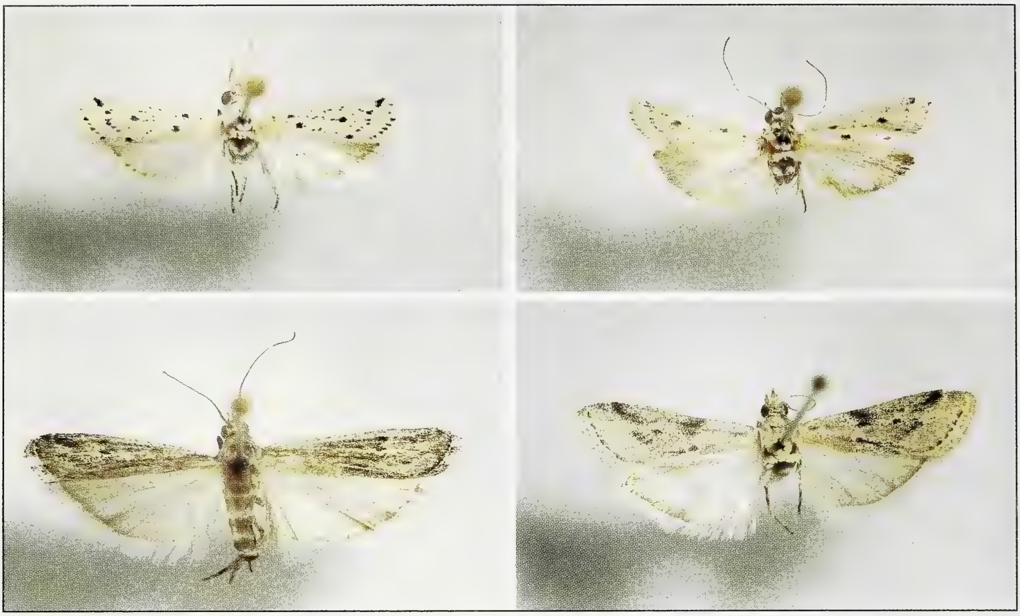


Figs. 1–4. Moths. **1.** *Myeloiodes minimella*, ♂. **2.** *Myeloiodes minimella*, ♀. **3.** *Ocrisiodes turkmeniensis*, ♂. **4.** *Prorophora kazachstaniella*, ♂.

white, porrect, $2^1/_2$ x eye diameter; 3rd segment drooping, $^1/_4$ x length of 2nd segment. Maxillary palps short: in male $^1/_2$ x length of 3rd segment of labial palps; in female a quarter of this length; in both sexes consisting of few, flat brown scales. Proboscis normally developed. Antennae ± $^5/_6$ forewing length; scape $3^1/_2$ x longer than wide and 2x wider than flagellum; base of flagellum with shallow inconspicuous sinus in male, pubescent in both sexes. Abdomen white.

Wings (Fig. 9). Male and female frenulum with only one bristle, as typical for Phycitinae. Wing venation quadrifid. Forewing sc, r_1, and r_2 normal; $r_3 + r_4$ on a common stalk, stalk about as long as r_4; m_1 and m_2 from outer edge of cell, $m_2 + m_3$ on minute common stalk from outer edge of cell; cu_1 and cu_2 from lower edge of cell; ax normal. Hindwing sc + rr from upper angle of cell on a common stalk, the latter about $^5/_9$ x length of rr; m_1 from cell and free though anastomose over short distance with common stalk of sc + rr; $m_2 + m_3$ short, ± equal in length and on long common stalk from lowest angle of cell, stalk 8x length of m_2 or m_3; cu_1 from lowest angle of cell and free though anastomose over short distance with common stalk of $m_2 + m_3$, an, ax_1, and ax_2 normal.

Diagnosis. Externally, *Myeloiodes minimella* looks like a small species of *Myelois* Hübner, 1825, subgenus *Gnathogutta* Roesler, 1988. However, *Myeloiodes* is remarkably different from *Myelois* by characters of the labial palps, male and female antennae, as well as male and female genitalia. The differences between *Myelois* Hübner, 1825 and *Myeloiodes* gen. n. are summarised as follows:

***Myelois* Hübner, 1825**	***Myeloiodes* gen. n.**
- Labial palps upcurved	- Labial palps porrect
- flagellum ciliate in both sexes	- flagellum pubescent in both sexes
- valva relatively broad	- valva slender, elongate
- vesica with plate or with bundles of minute spinules	- vesica with 2 cornuti
- culcita absent	- culcita present with 2 long scale tufts bilateral and a central membrane
- corpus bursa with signum	- bursa without signum, but with 2 rows of spines

Myeloiodes minimella sp. n. (Figs. 1, 2, 5, 8, 9)

Material. Holotype ♂, **Turkmenistan**, Nat[ional] Res[ervat] Amu Darja, env. Seidi, 28.v.1998, leg. Z. Kljutschko & O. Targonja, slide 4228 Ass. (ITZA). – Paratypes: 2♀, same data as holotype (slide 4243 Ass.), ITZA; slide 4231 Ass. (genitalia), 5100 A (forewing) and 5100 B (hindwing), coll. Asselbergs.

Description. Alar expanse $15^{1}/_{2}$–$16^{1}/_{2}$ mm; forewing length (fringe included) $6^{1}/_{2}$–$7^{1}/_{2}$ mm; forewings white sparsely sprinkled with black scales. Antemedian line indicated by 2 black dots, first at $^{1}/_{4}$ from wing base at upper margin of cell and second below first, more distally at $^{1}/_{3}$ from wing base and well above inner margin; postmedian line composed of 7 black dots running more or less parallel to termen, originating from costa at $^{4}/_{5}$ from wing base and reaching inner margin at $^{3}/_{4}$ from wing base so that both lines converge towards inner margin; with black dot at distal end of cell and row of 7 black dots at termen; fringe white. Hindwings white and semitransparent with darker suffusion at the apex and termen; fringe white.

Male genitalia (Fig. 5). Uncus triangular and apically rounded. Gnathos with short median process. Valva narrowest at base, gradually widening slightly and with costa moderately sclerotised; cucullus rounded. Juxta broadly V-formed with central membrane and sparsely bristled knob-like to digitate lateral processes. Vinculum a little less than 2x length of uncus, simple, with base rounded. Transtilla components present, slender and slightly longer than digitate processes of juxta. Tegumen normal with lateral parts medially intruding. Aedeagus stout, broad and slightly longer than valva; vesica with 2 tapering cornuti of unequal length, longest slightly less than $^{2}/_{5}$ x length of aedeagus, shortest about $^{2}/_{5}$ x length of former, also with numerous granulations. Abdominal segment 8 with V-shaped sclerotised base and central membranous tapering plate; 2 long scale bundles from both sides of base extend just beyond apex of plate.

Female genitalia (Fig. 8). Lobi anales subtriangular. Ostium membranous. Apophyses posteriores reaching slightly beyond edge of 8th segment, as long as apophyses anteriores. Ductus bursae moderately wide, $^{2}/_{7}$ x length of bursa. Corpus bursae elongate-ovate, posteriorly bilobed slightly with ductus bursae asymmetrically inserted; with 2 rows of spines unequal in length on each side; ductus seminalis originating proximally from longest row.

Life history. Unknown.

Distribution. Known from Turkmenistan, Amu Darja National Reserve, surroundings of Seidi.

Ocrisiodes Amsel, 1950

Type species: *Ocrisiodes chirazalis* Amsel, 1950

Diagnosis. *Ocrisiodes* belongs to the quadrifid Acrobasina. Within the genus, the maxillary palps can be absent. Characteristic are the often disrupted antemedian line in the forewing; veins m_2 and m_3 in the forewing both originate from the cell, strongly approximate basally; the hindwing have sc and rr with a common stalk over a long distance, the male genitalia have the lateral components of the gnathos characteristically curved; the female genitalia have no signum on the corpus bursae.

Ocrisiodes turkmeniensis sp. n. (Figs. 3, 6, 10)

Material. Holotype ♂, **Turkmenistan**, W. Kopet Dagh, Mt Sunt 700 m, Kara Kala, v.1998, leg. Z. Klutschko & O. Targonja (slide 4128 Ass.), ITZA. – Paratype ♂, same data as holotype (slide 4229), coll. Asselbergs.

Diagnosis. Wing pattern irregularly brown scaled on a creamy background with 3 blackish lines; male genitalia with a very broad uncus and relatively short, S-shaped valvae.
Description. Head. Vertex flatly curved and covered with cream coloured scales. Ocelli present immediately behind scape of antennae. Chaetosemata present well behind ocelli and close to edge of eye. Labial palps porrect, 1.5 times as long as diameter of compound eye, covered with cream coloured scales, suffused by a few light brown scales; 3rd segment about $^1/_3$ length of 2nd segment and drooping; maxillary palps small, about $^1/_3$ length of 3rd segment of labial palps. Antennae about $^3/_4$ forewing length; scape inflated dorsally, a little more than 2x longer than wide; flagellum filiform, sinus on first segments absent but with four minute spine-like chitinous projections on first four segments, cilia about half as long as width of flagellomeres.
Wings (Fig. 10). Forewing length 9 mm. Forewing sc, r_1 and r_2 normal; r_3 stalked with r_4, stalk from upper edge of cell and $^4/_9$ length of r_4; m_1 from the upper angle of cell; $m_2 + m_3$ on a common stalk from the lower angle of cell, the length of the stalk being a little less than $^1/_3$ of m_3; cu_1 from lower edge of cell, just below origin of common stalk $m_2 + m_3$; cu_2 more basal from lower edge of cell; ax1 normal. Hindwing quadrifid, with one frenulum bristle; cubital pecten present; sc and rr on common stalk, the latter about half length of rr; m_1 from upper angle of cell; $m_2 + m_3$ on a common stalk from the lower angle of cell, stalk as long as free branch of m_2; cu_1 from lower angle of cell; cu_2 more basal from lower angle of cell; an, ax_1, and ax_2 normal. Forewing cream coloured, irregularly suffused with brown scales; costa dark brown, contrasting with remaining part of wing; pattern with three dark brown longitudinal lines, first immediately below costa, second in middle of wing, and the third above inner margin; antemedian line inconspicuous except for few brown scales below costa at $^3/_8$ from base; postmedian line at $^7/_8$ from base, dark edged inwardly, mainly toward costa, dorsal quarter running obliquely in direction of base before reaching inner margin at 3/4 from base; with two superposed discoidal black dots slightly extended longitudinally; fringe white with two dark dividing lines. Hindwing greyish white and

slightly transparent, slightly darker at apex and termen; fringe white divided by brownish line near margin.

Male genitalia (Fig. 6). Uncus very wide with straight lateral margins gradually widening distally; gnathos curved downwards which is characteristic of *Ocrisiodes*. Gnathos like equilateral triangle. Tegumen slender. Processes of juxta slender, parallel-sided, and distally with some hairs. Valvae S-shaped, widest at base, sharply tapering distally, and with ventral half heavily sclerotised; sacculus thickly melanised, with some hairs. Aedeagus straight, about $^1/_5$ longer than valva, widest part as wide as valva at greatest width; vesica granulated proximally, with two big cornuti about $^2/_5$ length of aedeagus. 8th segment with two scale tufts of about $^5/_7$ length of aedeagus.

Female. Unknown.

Life history. Unknown.

Distribution. Known from the western part of the Kopet Dagh at an altitude of 700 m.

Prorophora Ragonot, 1887

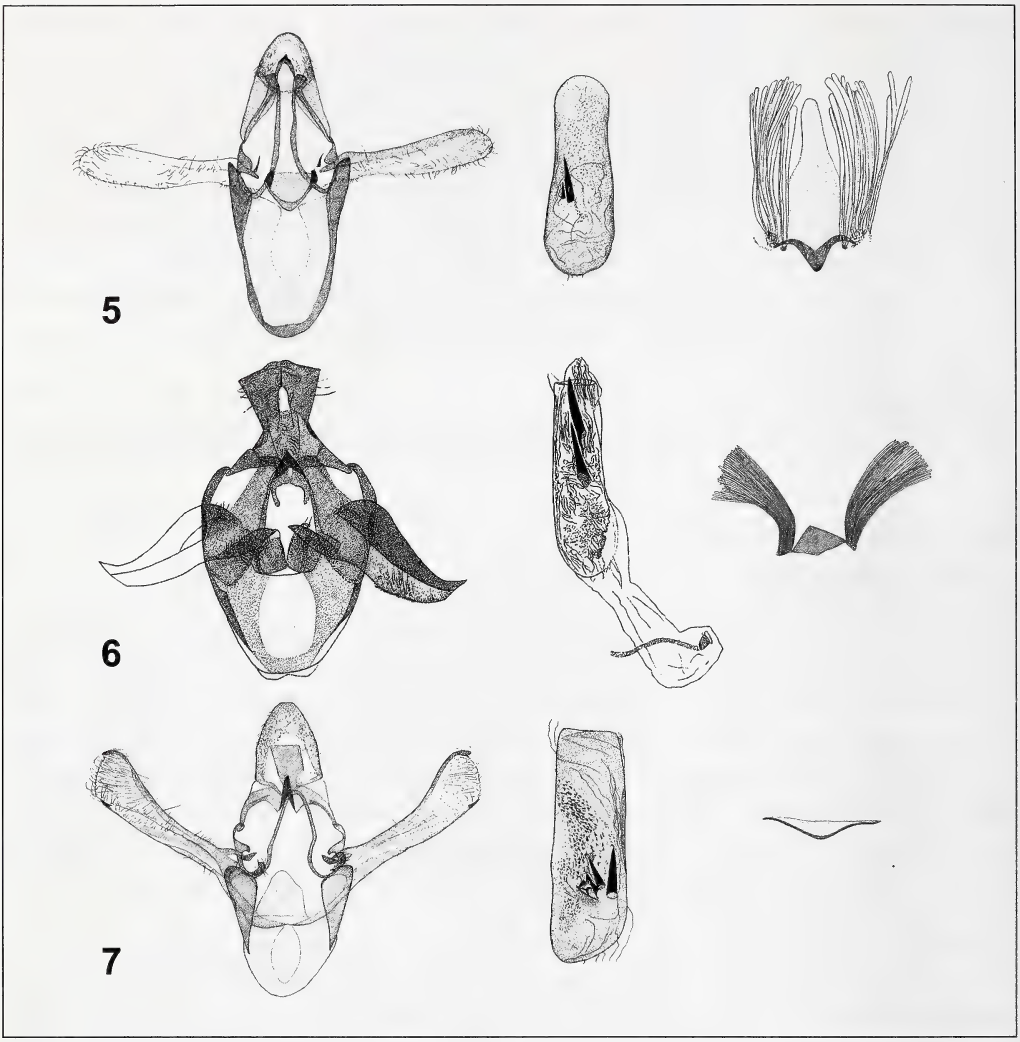
Type species: *Prorophora curvibasella* Ragonot, 1887

Diagnosis. *Prorophora* Ragonot, 1887 is divided into three subgenera, *Prorophora* Ragonot, 1887, *Reisserempista* Roesler, 1970, and *Epischidia* Hampson, 1901. Subgenus *Prorophora* differs from *Reisserempista* by the absence of maxillary palps and, as a rule, by the absence of tiny chitinous projections on the first 3(2)–9(6) male flagellomeres; in *Epischidia* the maxillary palps are present and the chitinous projections on the first flagellomeres are absent; exceptions are *Prorophora* (*Prorophora*) *kazachstaniella* sp. n. which has 5 tiny chitinous projections on the flagellomeres 2–6, and *Prorophora* (*Epischidia*) *albunculella* (Staudinger,1879) which sometimes has such projections on flagellomeres 3–9.

Description. Head. Vertex surrounded by sclerified wall with spine-like or laterally compressed and crest-like projection almost as long or as long as diameter of eye; usually covered with long projecting scales extending beyond antennae. Maxillary palps small or absent. Labial palps porrect, sometimes a little upcurved, 3rd segment straight or drooping. Proboscis developed. Antennae filiform and ciliate or pubescent; flagellomeres 3–9 in males of some species with 3–9 small spine-like chitinous projections dorsally.

Wings. Forewing sc, r_1 and r_2 free, $r_3 + r_4$ on a common stalk, the latter about as long as free branch of r_4; m_1 from upper angle of cell; m_2 and m_3 on very short common stalk always shorter than quarter of length of free branches of m_2 and m_3; cu_1 from lower angle of cell and cu_2 more basally from lower edge of cell; ax_1 normal; ax_2 as a small groove near base. Hindwing trifid; sc and rr on common stalk, stalk about $^1/_3$ of combined length of sc+rr; m1 a little basal from upper angle of cell ; m_2 coinciding with m_3; m_3 and cu_1 on common stalk from lower angle of cell, stalk $^1/_2$ length of free branches of m_3 and cu_1; cu_2 a little more basal at lower edge of cell; an, ax_1 and ax_2 normal.

Male genitalia. Uncus ovate, terminally rounded. Gnathos sharply tongue shaped apically, lateral branches stout, widest basally, ventral parts of lateral components



Figs. 5–7. Male genitalia (left), with aedeagi (center), and culcitae (right). **5.** *Myeloiodes minimella.* **6.** *Ocrisiodes turkmeniensis.* **7.** *Prorophora kazachstaniella.*

more sclerified in some specimens. Tegumen with slender but sometimes wide medial parts; in some cases with semicircular sclerotised structure present between tegumen and insertion of costa of valva. Transtilla, if present, small and paired. Juxta variable in shape and with or without lateral processes. Valva mostly narrow and elongate; in some species with costa extending beyond cucullus; sacculus variable in shape, usually tapering distally. Vinculum extended or compact with flat or rounded base. A culcita can be present.

Female genitalia. Ovipositor compact, not or very slightly extendable. Antrum mostly well defined. Bursa rounded or ovate with simple or paired signa. Ductus seminalis arising from lobe near transition between ductus seminalis and corpus bursae.

Remarks. The description of the wing venation is based on *Prorophora* (*Prorophora*) *curvibasella* Ragonot, 1887. It is assumed that the veins do not vary significantly within the subgenus.

***Prorophora* (*Prorophora*) *kazachstaniella* sp. n.** **(Figs. 4, 7)**

Material. Holotype ♂, Kazakhstan W, 10 km SW Kulsari, 06.v.2000, leg. V. Karalius & J. Miatleuski (slide 5325 Ass.), ITZA.

Description. Head. Vertex with a crest-like, laterally compressed projection about $^3/_4$ as long as diameter of eye with 2 superposed small teeth of ± equal length distally; scales long, extending anteriorly, cream coloured medially, partly brown laterally; Ocelli present at base of scape. Chaetosemata present. Maxillary palps absent. Labial palps two times as long as diameter of eye, porrect or slightly ascending with adjacent cream coloured, partly brown scales; 3rd segment $^1/_4$ length of 2nd segment, drooping. Antennae $^3/_4$ forewing length, scape 2.25x longer than wide; flagellum filiform, dorsally annulate, without sinus but with five small spine-like projections on flagellomeres 2–6; cilia $1^1/_2$ time longer than width of flagellomeres.

Thorax and abdomen. Thorax, including tegulae, with cream coloured and brown scales intermixed, patagia with dorsally projecting cream coloured scales;. Abdomen cream coloured.

Wings. Forewing 9 mm long; elongate subtriangular; costa straight till $^4/_5$, then curved towards apex; termen oblique; ground colour creamy white; antemedian line white, starting at $^1/_3$ of costa in a blunt angle, running weavy to middle of inner margin, near costa dark edged outwardly; two black stigmata adjacent to antemedian line, anterior stigma dot-like, posterior stigma a long streak parallel to inner margin, ending shortly before postmedian line; postmedian line white, dark edged inwardly, originating on costa at about $^6/_7$ before running toward base, with acute angle about halfway, then directed toward base before ending on inner margin at $^4/_5$; with two dark superposed discoidal spots: dorsalmost more obvious and slightly closer to base; termen with row of dark brown spots; fringe white, with two brown lines. Hindwing semitransparent; apex and termen a little darker; fringe white.

Male genitalia (Fig. 7). Uncus ovate, rounded terminally. Gnathos sharply tongue-shaped apically, lateral branches large, widest basally, with ventral section thickly melanised. Tegumen slender with semicircular thickly sclerified plate between junction of tegumen and costa. Transtilla paired, components small and subtriangular. Juxta without lateral processes. Valva narrow, elongate, with longitudinal weak ridge between costa and ventral edge adorned with a few setae; sacculus tapering distally; ventral edge terminally with small sharp spine below cucullus. Vinculum compact with base rounded. ventral edge of 8th segment flatly V-shaped. Culcita absent.

Female. Unknown.

Life history. Unknown.

Distribution. Known from western Kazakhstan.

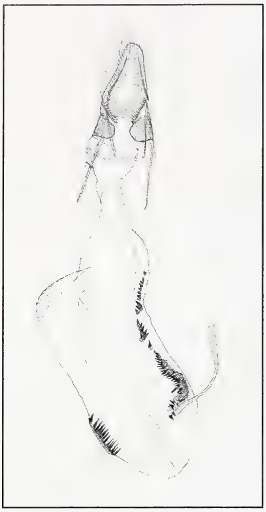
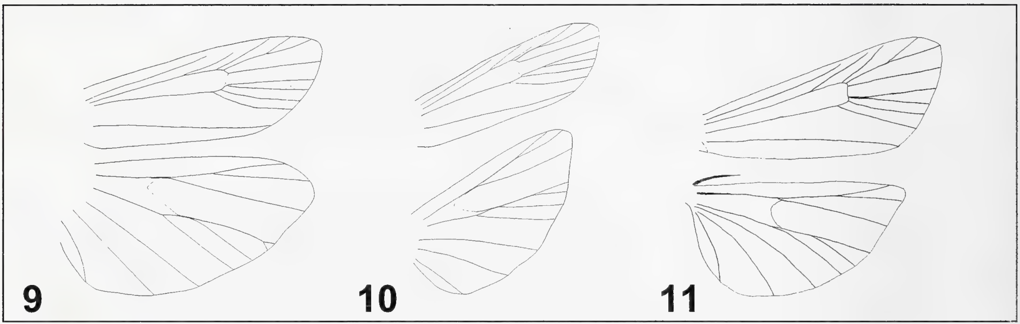


Fig. 8. Female genitalia of *Myeloiodes minimella*.



Figs. 9–11. Wing venation. **9.** *Myeloiodes minimella*. **10.** *Ocrisiodes turkmeniensis*. **11.** *Prorophora curvibasella*.

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Zum System der palaearktischen Psychidae. 3. Teil: Bestimmungsschlüssel für die Säcke

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Abstract. Differences in the morphology of larval and pupal cases from different insect orders are discussed and an identification key is given for the cases of Psychidae from the Palaearctic region.

Zusammenfassung. Es werden Unterschiede in der Morphologie der Säcke von Larven und Puppen aus verschiedenen Insektenordnungen diskutiert und ein Bestimmungsschlüssel für die Säcke der Psychidae der Paläarktis gegeben.

Key words. Trichoptera, Lepidoptera, Psychidae, Tineidae, Coleophoridae, larval cases, identification key.

Einleitung

Ein auffälliges und dementsprechend auch namengebendes Merkmal der Psychiden sind die von den Raupen gebauten Säcke (“Sackträger”, “bagworms”). Sie sind oft ein nützliches Merkmal zur Bestimmung der Gattungen; in einigen Fällen, so bei *Epichnopterix* Hübner, [1825] aber auch sehr hilfreich bei der Artbestimmung. Die Säcke werden von den Raupen zeit ihres Lebens bewohnt und auch zur Nahrungsaufnahme nicht verlassen. Anschliessend dienen sie noch als Puppenwiege und bei den meisten Arten auch noch als Ablegeplatz für die Eier. Zudem sind sie meist recht robust gebaut und bleiben über den Abschluss des Lebenszyklus hinaus noch erhalten. Säcke sind deshalb viel leichter zu finden als die kurzlebigen Imagines. Es entspricht deshalb einem praktischen Bedürfnis, Säcke bestimmen zu können. Das ist leider nicht in allen Fällen möglich. Im folgenden soll aber versucht werden, einen praktikablen Schlüssel zusammenzustellen. Bei frisch vom Falter verlassenen Säcken bleibt auch die leere Puppenhülle meist noch einige Zeit erhalten. Sie bietet weitere Möglichkeiten der Arterkennung. Dieses Merkmal wird in der Tabelle nur an wenigen Stellen erwähnt, da die Publikation eines Puppenschlüssels durch Jan Patocka in nächster Zeit zu erwarten ist.

Die Psychiden sind nicht die einzigen Insektenlarven, die Säcke bauen. Viele Arten der Trichopteren (Köcherfliegen) sind ebenfalls Sackbauer. Das Produkt ihrer Tätigkeit ist oft sehr ähnlich dem der Psychidenraupen: Auch hier werden verschiedenste Fremdpartikel zum Sackbau mit verwendet, auch hier sind die Säcke dementsprechend recht vielgestaltig. Die Unterscheidung zwischen den beiden Gruppen ist aber insofern einfach, als fast alle Köcherfliegenlarven im Wasser leben, die Psychiden aber durchwegs Landtiere sind. Bei uns leben nur die Larven der Köcherfliegengattung *Enoicyla* Rambur, 1842 auf dem Land. Man findet Säcke an moosigen Stellen und in der Laubstreu von Buchenwäldern manchmal in grosser Anzahl. Es sind Säcke, die konisch, gebogen sind und aus Sandkörnern, eventuell auch etwas Pflanzenteilen gebaut sind. Sie erinnern damit an Säcke der Gattung *Rebelia* Heylaerts, 1900 (Abb. 1B).

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Weitere Sackkonstrukteure finden wir in verschiedenen Schmetterlingsfamilien. Zu Verwechslungen Anlass geben für den Anfänger vor allem Vertreter von Tineiden (Echte Motten) und Coleophoriden (Sackträgermotten). Bei ersteren sind es nur wenige Gattungen, bei letzteren stellt der Sackbau die Norm dar. Die Säcke der Tineiden bestehen aus Gespinst, das mit feinen Partikeln bekleidet sein kann. Die beiden Sackenden stimmen überein und sind gleich gebaut. Die Säcke sind röhrenförmig mit einfachen Enden wie etwa bei *Tinea* Linnaeus, 1758 (Abb. 2), sie können auch abgeflacht und mit dachförmig erweiterten Enden versehen sein, so dass die Mündungen auf die Ventralseite zu liegen kommen und das ganze Gebilde bilateral symmetrisch wird, wie etwa bei *Eudarcia* Clemens, 1860. Die Raupen fressen Algen und Flechten oder auch tierische Produkte, wie Haare usw. Die Säcke der Coleophoriden sind sehr unterschiedlich gebaut (Beispiel Abb. 3) und dienen bei der artenreichen Gruppe (*Coleophora* Hübner, 1822 ist in Europa mit etwa 500 Arten vertreten (Sauter, nicht veröffentlicht) seit jeher als wichtiges Bestimmungsmerkmal. Als Baumaterial dient wiederum die von den Raupen erzeugte Seide. Dazu können in mehr oder weniger grossem Umfang mineralische Partikel oder Pflanzenteile kommen, die oft auch den Hauptteil des Sackes ausmachen. Gewisse Arten benutzen minierte Stengelstücke oder ausgefressene Samen als Sack. Abgesehen von letzteren sind Coleophoridensäcke meist deutlich bilateralsymmetrisch gebaut und Vorder- und Hinterende deutlich unterscheidbar. Einen guten Eindruck von der Vielfalt der Sackformen in dieser Familie geben die Abbildungen bei Emmet (1996: Taf. 1–8). Bucheli, Landry & Wenzel (1992) untersuchten die Architektur nordamerikanischer *Coleophora*-Säcke und unterzogen die Merkmale zusammen mit Informationen über die Nahrungspflanzen der Raupen einer cladistischen Analyse. Damit stellen sie erstmalig eine Hypothese über phylogenetische Beziehungen zwischen Artengruppen der Gattung *Coleophora* auf. Coleophoriden-Raupen sind zeitlebens Minierer, doch minieren sie vom Sack aus, den sie auf dem Nahrungssubstrat temporär festspinnen und scheiden den Kot durch die Hinteröffnung des Sackes aus. So bleiben die Minen im Gegensatz zu anderen Minierern, die in der Mine leben, kotfrei. Ist die Umgebung um den Sack abgefressen, wird der Sack gelöst und an einer anderen Stelle neu befestigt. Dagegen findet man Minen bei den Psychiden einzig bei der Gattung *Apterona* Millière, 1857, die aber an ihren schneckenhausförmig gebauten Säcken leicht zu erkennen ist. Coleophoriden spinnen ihre Säcke für die Verpuppung, die ebenfalls im Sack stattfindet, an einen festen Untergrund, wo der Zusammenhang mit den Minen oft nicht mehr erkennbar ist. Beim Schlüpfen bleibt die Puppenhülle ganz im Sack, im Gegensatz zu den Psychidenmännchen und einem Teil der Weibchen.

Weniger Anlass zu Verwechslungen dürften die Säcke der Incurvariidae, Prodoxiidae und Adelidae (Langhornmotten) bieten. Hier leben die Raupen der ersten Stadien als Minierer. Später leben sie in der Bodenstreu von sich zersetzendem Pflanzenmaterial. Dabei wohnen sie in flachen, zweikantigen Säcken aus toten Blattstücken. Diese Säcke sind sehr charakteristisch, sie erinnern etwas an ein Brillenfutteral (siehe Heath 1976: Taf. 9 Fig. 1–13; Küppers 1980: Taf. 9–12). Mit dem Wachstum der Raupe wird der Sack durch Ansetzen weiterer Blattstückchen vergrössert. Die Verpuppung erfolgt auch hier im Sack.

Zur Morphologie der Psychidensäcke

Die Säcke der Psychiden zeigen folgende Merkmale: Vorder- und Hinterende sind morphologisch unterscheidbar. Durch die vordere Öffnung kann die Raupe den Kopf und die Brustsegmente herausschieben und sich mit Hilfe der Brustfüsse bewegen, während der Hinterleib im Sack verbleibt und die Bauchfüsse diesen festhalten. Das Hinterende dient der Kotabgabe und später dem Schlüpfen der Imago (Abb. 4). Bei Arten, bei denen das Weibchen den Sack nicht verlässt, erfolgt durch die hintere Öffnung auch die Kopulation. Zwei Grundtypen sind zu unterscheiden: Die Säcke in den Unterfamilien Naryciinae und Taleporiinae sind im Querschnitt dreieckig mit meist deutlichen Kanten (Abb. 5). Die Säcke der anderen Unterfamilien haben runde, rundliche oder ovale Sackquerschnitte (Abb. 6). Es sind nur wenige Ausnahmen bekannt, bei denen der Querschnitt durch das äussere Fremdmaterial verändert wird. So sind beispielsweise die kunstvoll quer belegten Säcke der Gattung *Amicta* Heylaerts, 1881 quadratisch (Abb. 7) und jene von *Orophora triangularis* Das, 1956 dreieckig. Bei diesen Säcken ist der äussere Belag mit Fremdmaterial um den rundlichen Seidensack angeordnet (Abb. 6). Nach dem Material und der Anordnung des äusseren Belages der Säcke können die folgenden Gruppen unterschieden werden:

- Säcke nur aus Seide, ohne auffallenden, äusseren Belag von Fremdmaterial (Abb. 1A).
- Äusserer Belag aus mineralischen Materialien wie Sand oder Steinchen, manchmal auch Insektenteilen oder Kot (Abb. 1B).
- Äusserer Belag aus Pflanzenteilen, Grasstücken oder Blattfragmenten.

Die mit Pflanzenteilen belegten Säcke können weiter unterschieden werden:

- Belag dominierend längs angeordnet (Abb. 8A)
- Belag dominierend quer angeordnet (Abb. 8B)
- Belag wirr angeordnet (Abb. 8C).

Selbstverständlich sind auch hier individuelle Unterschiede zu sehen, denn das zur Verfügung stehende Baumaterial, aber auch Störungen während der Bauphasen im Raupenleben können das Erscheinungsbild der Säcke beeinflussen. Bei massenhaftem Auftreten im Freiland, aber auch bei Zuchten bei denen nicht genügend oder nicht das richtige Baumaterial zur Verfügung steht, kann es passieren, dass die Raupen sich gegenseitig Material von den Säcken stehlen oder sogar einen ganzen Schwestersack als Baumaterial verwenden, was dann allerdings meistens zum Tode der einen Raupe führt. Bei Zuchten der grossen Arten *Canephora unicolor* (Hufnagel, 1766) und *Pachythelia* villosella (Ochsenheimer, 1810) wurden bei Mangel an dürren Blättern Stücke aus einer Zeitung herausgebissen und in den Sackbelag eingebaut. In einem Fall wurden sogar Stücke aus der Polyestergaze des Zuchtkastens herausgebissen und angesponnen.

Bei einigen Arten, speziell in der Tribus Acanthopsychini, haben die kleinen Jugendsäcke ein stark abweichendes Aussehen (Abb. 9). Bei der Vorbereitung zur Verpuppung werden bei vielen Arten die Säcke verändert. Bei einigen Arten der Gattungen *Acanthopsyche* Heylaerts, 1881 und *Oiketicoides* Heylaerts, 1881 beißen die Raupen beider Geschlechter, bei anderen Arten nur die Männchen, den äußeren

Belag ganz oder teilweise wieder ab (Abb. 10), wodurch ein anderes Aussehen des Sackes entsteht. Bei verschiedenen Arten, oft aber nur bei einem Teil der Raupen, vergraben diese den Sack zur Verpuppung ein Stück weit oder fast vollständig in der Erde. Sicher erleichtert die, durch das Abbeissen feiner gewordene Sack-Oberfläche die Arbeit des Eingrabens. Einige Raupen verlängern nachher das vordere Sackende weiter in die Erde hinein. Dieser Teil des Sackes besteht aus Seide, er bleibt abgesehen von Erdteilchen, die an der Oberfläche kleben, ganz ohne Belag aus Fremdmaterial. Die Raupen der gleichen Population, die ihre Säcke nicht eingraben verhalten sich insofern gleich, als sie die Grashalme in der Regel auch abbeißen.
Die Raupen mehrerer Arten aus den Gattungen *Ptilocephala* Rambus, 1866 und *Phalacropterix* Hübner, [1816] spinnen einen, von Art zu Art unterschiedlich dichten Belag von grauer Seide um das Äussere des Sackes. In den Hohlräumen zwischen den meist sperrig, quer angesponnenen Grashalmstücken bleiben gegen Feuchtigkeit und Kälte isolierende Luftpolster (Abb. 11B).
Vor der Verpuppung wird das hintere Ende des Sackes, der Ausgang der Imago, zum Schlüpfen vorbereitet. Das ist auffallend bei den männlichen Raupen einiger Arten aus der Unterfamilie der Oiketicinae, die aus weisslicher Seide eine oft mehrere Millimeter lange Röhre spinnen (Abb. 12).
Die Raupen von *Ptilocephala sicheliella* (Bruand, 1858) schneiden kurz vor der Verpuppung ein rundliches Stück aus einem dürren Blatt und befestigen dieses aussen auf der Rückenseite des Sackes. Dadurch ist von oben nur noch das Blattstück sichtbar, der eigentliche Sack ist darunter gut versteckt.

Bestimmungsschlüssel

Der folgende Schlüssel soll die Bestimmung der Säcke der Gattungen der paläarktischen Psychidae ermöglichen. Allerdings lagen nicht für alle Gattungen Säcke vor und bei einigen Gattungen konnten bei diesen keine trennenden Merkmale gefunden werden. Für *Placodoma* Chrétien, 1915, *Anatolopsyche* Sugimoto & Saigusa, 2001 und *Tayalopsyche* Sugimoto & Saigusa, 2002 sind zwar Säcke bekannt, aber die Beschreibungen erlauben keine sichere Einordnung in den Schlüssel. Von *Eudahlica* Solyanikov, 2000, *Kurenzovia* Solyanikov, 2001 und *Hyalopteronia* Solyanikov, 2002 sind die Säcke bislang noch nicht beschrieben. Bei der Beurteilung der Merkmale muss immer berücksichtigt werden, dass es sich um Gebilde handelt, die von Raupen gebaut werden und durch den Lebensraum, dem Angebot an Baumaterial und Witterungseinflüsse starken Streuungen unterworfen sind. Wenn "Sack ohne Belag" angegeben ist, soll von blossem Auge kein Belag sichtbar sein. Es kann aber zutreffen, dass bei Vergrösserung feiner Sand oder Staub sichtbar wird. Oft ist durch die individuellen Unterschiede schlecht unterscheidbar, ob das Material längs, quer oder wirr angeordnet ist. Der Vergleich mehrerer Säcke kann helfen, eine Entscheidung zu fällen. Wenn das nicht zutrifft, kann das Verfolgen beider Linien zum Ziel führen. Leider wird es immer wieder Säcke geben, die mit diesem Schlüssel nicht eindeutig zugeordnet werden können. Der Schlüssel gilt für Säcke verpuppungsreifer Raupen oder Puppen, nur bei wenigen Arten sind die Unterscheidungsmerkmale schon im Jugendstadium erkennbar. Bei alten, verwitterten Säcken kann das Aussehen verändert sein. Die Grössenangaben beziehen sich auf Säcke erwachsener Raupen.

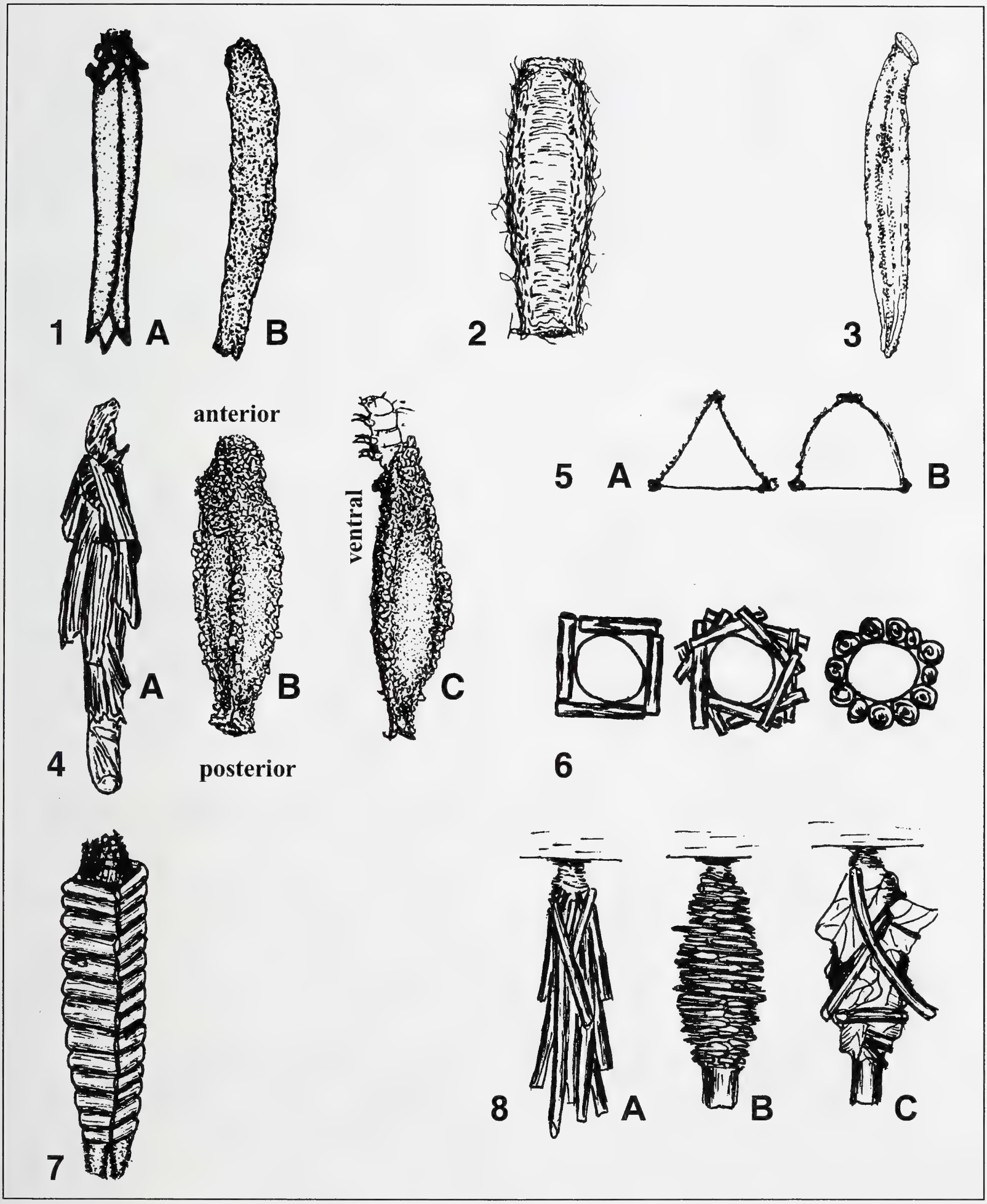

Abb. 1–3. Larvensäcke verschiedener Lepidopterea. **1A.** Psychidae: *Taleporia*. Sack aus Seide, äußerer Belag aus sehr feinem, kaum erkennbaren Fremdmaterial, an den Kanten oft gröberes Material. **1B.** Psychidae: *Rebelia*, Sack röhrenförmig, außen mit Sand belegt. **2.** Sack von *Tinea pellionella* Linnaeus, 1758 (aus Hättenschwiler 1997). **3.** Sack einer Coleophoride (aus Hättenschwiler 1997).

Abb. 4. Larvensäcke verschiedener Psychidae und Terminologie. **A.** *Bijugis bombycella*, ♂. **B–C.** *Dahlica triquetrella*, B: Dorsalansicht, C: Lateralansicht (B+C nach Galliker 1958, verändert).

Abb. 5–7. Querschnitte der Larvensäcke verschiedener Psychidae. **5.** Naryciinae und Taleporiinae, A: Seiten eingefallen, B: Seiten bauchig. **6.** Andere Unterfamilien, die Seidenröhre ist unabhängig vom äußeren Belag rundlich bis oval. **7.** Im Querschnitt quadratischer Sack von *Amicta* sp.

Abb. 8. Außen mit Pflanzenteilen belegte Säcke: **A.** Belag in Längsrichtung, **B.** Belag in Querrichtung, **C.** Belag wirr angeordnet.

1) Sack im Querschnitt dreieckig (Abb. 5), am besten am Hinterende des Sackes erkennbar. (Puppenhüllen mit dorsalen Dornenfeldern auf mehreren Abdominalsegmenten, Abb. 13A) **2**

- Sack im Querschnitt rund oder oval (Abb. 6) (Puppenhüllen mit ein- bis zwei dorsalen Dornenreihen auf mehreren Abdominalsegmenten, Abb. 13B) **9**

2) Sack besteht aus hartem Innensack und weichem Außensack (bei allen Arten ?), der aus Rinden-, Flechten- oder Insektenteilen besteht, man trifft auch Steinchen, kleine Schneckenhäuschen und andere Materialien. ***Diplodoma***

- Sack nur einfach, alle Seiten mit feinem Sand, Flechten oder Algen belegt, vorderes Ende oft mit lose angesponnenen Fragmenten von toten Insekten und Spinnen verziert **3**

3) Sacklänge meist mehr als 12 mm, hinteres Ende deutlich dreieckig, mit drei von außen sichtbaren und drei inneren Lappen verschlossen (Abb. 14). Der vordere Teil im Querschnitt oft rundlich scheinend, mit Chitinteilen um die in Längsrichtung liegende vordere Öffnung (Abb. 1A, 14). (*T. defoliella* Constant, 1895 nur 8 mm lang, innere Lappen nicht erkennbar) ***Taleporia***

- Sacklänge kürzer als etwa 12 mm, Öffnung am vorderen Ende gegen die Bauchseite gerichtet, hinteres Ende mit drei Lappen verschlossen, ohne innere Lappen (Abb. 15) **4**

4) Sack meist weich, Seiten oft auffallend nach innen gewölbt, Rückenkante deutlich erkennbar (Abb. 5A). Verhältnismäßig große Säcke, meist über 8 mm. **5**

- Sack meist härter bis auffallend starr, seitlich flach oder nach außen gebaucht, Rückenkante oft undeutlich oder nur durch gröberen Belag erkennbar (Abb. 5B) (excl. ♂ *P. clathrella*, siehe Punkt 8). Sack meist unter 8 mm **6**

5) Außenseite mit mineralischem Material, wie Sand und Steinchen, ab und zu auch mit Kotteilen belegt. Am Vorderende oft mit Chitinteilen von toten Insekten und Spinnen verziert ***Dahlica triquetrella***

- Sack Aussenseite mit organischem Material, wie Flechten (oft weissliche Krustenflechten) oder Algen belegt, keine Chitinteile am vorderen Sackende ***Pseudobankesia***

6) Sack belegt mit mehrheitlich organischem Material, oft mit grünen Algen. Sack meist breiter als hoch, mit schwacher Rückenkante ***Narycia***

- Sack belegt mit mehrheitlich mineralischem Material, etwa so breit wie hoch, mit schwacher Rückenkante. Alte Säcke oft mit Algen bewachsen **7**

7) Sack kürzer als etwa 9 mm ***Paranarychia*, *Dahlica*, *Siederia*, *Postsolenobia*, *Brevantennia*, Sauterelia, *Eotaleporia*, *Bankesia*, *Altobankesia*, *Sciopetris*, *Kozhantshikovia*, *Sauterelia***

- Sack länger als etwa 9 mm **8**

8) Säcke beider Geschlechter etwa gleich breit ***Eosolenobia***

- ♂ Säcke eher weich, im Vergleich zu den härteren ♀-Säcken auf etwa doppelte Breite aufgebläht ***Praesolenobia***

9) Sack röhrenförmig, aus Seide, ohne Belag oder nur mit feinem, von Auge kaum erkennbarem Sand oder Staub, in einigen Fällen auch mit vereinzelten, kleinen Pflanzenteilen belegt (Abb. 16A) **10**

- Sackbelag aus mineralischem oder organischem (Pflanzenteile) Fremdmaterial vorhanden **13**

10) Sack während den Häutungen und der Puppenruhe am vorderen Ende an Faden aufgehängt (Abb. 17) **11**

- Sack, am vorderen Ende direkt auf Unterlage festgesponnen, ohne Faden (Abb. 18) **12**

11) Faden ist axial am vorderen Ende des Sackes angebracht (Abb. 17A) ***Eumetisa, Pteroma***

- Faden ist seitlich am vorderen Ende des Sackes angebracht (Abb. 17B) ***Metisa***

12) Sack schneckenhausartig gewunden (Abb. 19) ***Apterona***

- Sack gestreckt, gerade, kaum gebogen (Abb. 16A) ***Chalioides***

13) Sackbelag dominierend mineralisch (Sand, Steinchen, Glimmerplättchen) **14**

- Sackbelag organisch (diverse Pflanzenteile) **19**

14) Sackbelag rein mineralisch, Sand, Steinchen oder Glimmerplättchen **15**

- Sackbelag mineralisch mit vereinzelten pflanzlichen Teilen an der Oberfläche oder nur Rückenseite mit Pflanzen- Fragmenten, die oft nur einseitig befestigt sind (Abb. 20) ***Loebelia, Leptopterix*, Peloponnesia****

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* Innerhalb einiger Gattungen bauen einzelne Arten unterschiedliche Säcke, so dass diese Gattungen an mehreren Stellen im Schlüssel erscheinen.

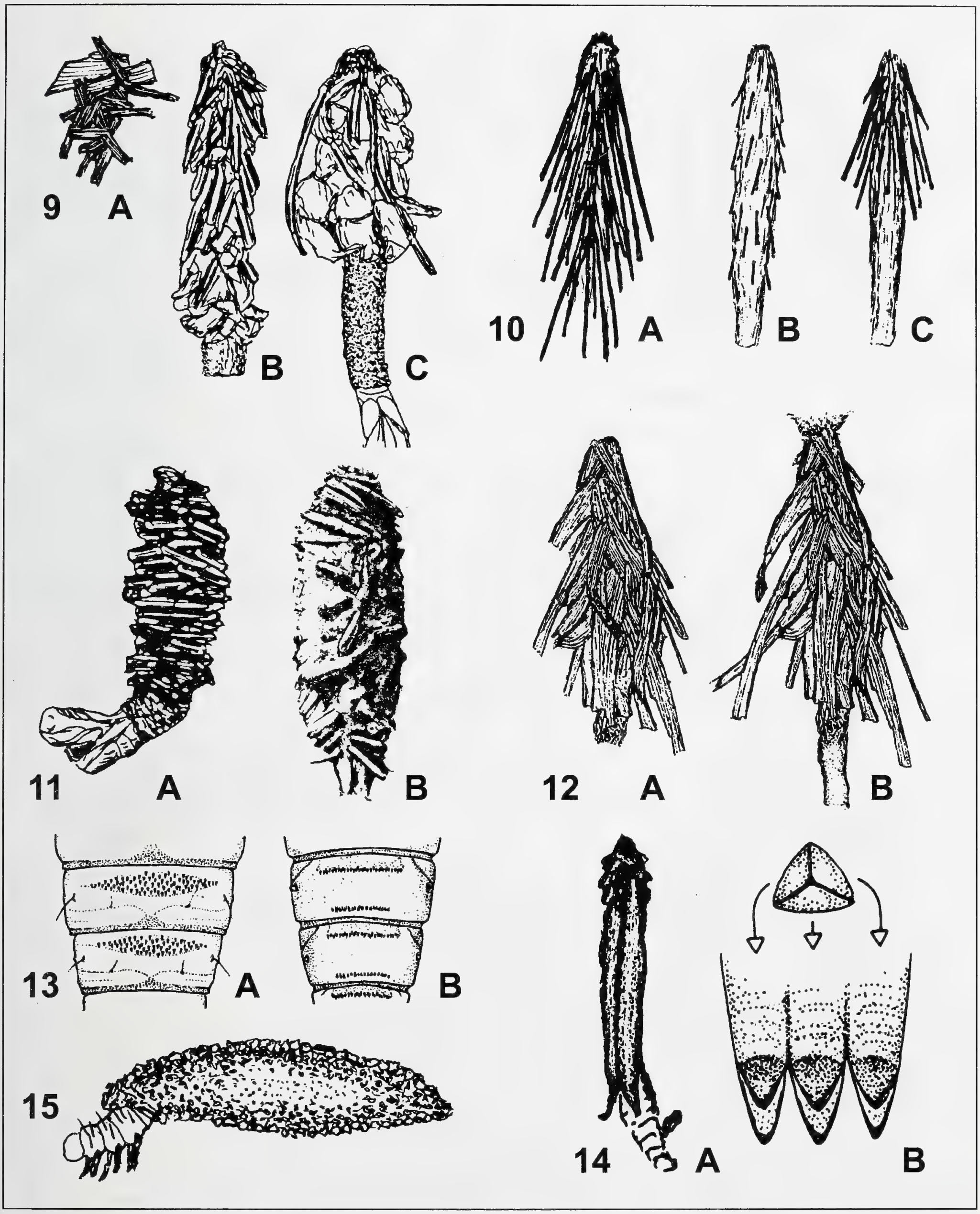


Abb. 9. *Canephora unicolor*, **A.** Jugendsack, **B.** ♀-Sack, **C.** ♂-Sack.

Abb. 10. Vor der Verpuppung veränderte Säcke. **A.** Sack ausgewachsener Raupe mit in Längsrichtung angeordneten Pflanzenteilen, **B.** ♂-Puppensack von *Oiketicoides febretta*, der Belag ist abgenagt. **C.** ♂-Puppensack von *Acanthopsyche ecksteini* (Lederer, 1855), ein Teil des Belages ist abgenagt.

Abb. 11. Quer belegte Larvensäcke: **A.** Ohne Umspinnung. **B.** Umsponnen (aus Hättenschwiler 1997).

Abb. 12. Säcke von *Oiketicoides* spp., **A.** ♂ ohne angesponnene Endröhre, **B.** mit angesponnener Endröhre.

Abb. 13. Abdominaltergite der Puppe. **A.** Dornenfeld, **B.** Dornenreihen (aus Hättenschwiler 1997).

Abb. 14. Sack von *Taleporia* sp., Belag kaum erkennbar. **A.** Gesamtansicht, **B.** Hintere Öffnung, die durch doppelte Lappen verschlossen ist (aus Hättenschwiler 1997).

Abb. 15. Sack einer Narycinae mit zur Bauchseite gerichteter Vorderöffnung, von lateral.

15) Sack leicht gebogen **16**

- Sack gerade, nicht gebogen **17**

16) Sack kürzer als etwa 22 mm ***Rebelia, Psychidopsis, Psychocentra, Psychidea, Acentra, Dissoctenioides, Armidalia***

- Sack länger als etwa 22 mm ***Typhonia, Ptilocephala****

17) Sack 12–20 mm lang (Abb. 16A) ***Dissoctena, Eudissoctena, Eumelasina, Eochorica, Oreopsyche***

- Sack gerade, jedoch kürzer **18**

18) Sack etwa 6–8 mm lang, im Raupenstadium stark konisch, Zipfelmützen-förmig (Abb. 21B+C). Oft senkrecht vom Untergrund abstehend ***Luffia***

- Sack schwach konisch, 6-10 mm lang, am vorderen Ende oft mit Chitinteilen von Insekten und Spinnen belegt (Abb. 21A) ***Eumasia***

19) Pflanzenteile mehrheitlich kürzer als Sacklänge (Abb. 22 A) **20**

- Fremdmaterial: Teile so lang wie der Sack oder länger (Abb. 22 B) **30**

20) Fremdmaterial wirr am Sack angebracht. Dieser Punkt ist oft undeutlich bei Blattfragmenten oder Grashalmen, die gegen das hintere Sackende gerichtet jedoch stark nach aussen abstehend sind, im Zweifelsfall hier weiter suchen (Abb. 23D, E, F) **21**

- Sackbelag längs oder quer angeordnet (Abb. 23A, B, F) **24**

21) Oft Blattfragmente oder Grashalme, Sack bei Häutungen und zur Verpuppung an Faden aufgehängt (Abb. 23C) ***Metisa*, Eumetisa, Brachycyttarus****

- Sack meist nur mit vereinzelten Pflanzen- oder Flechtenteilen belegt, er wird direkt an Unterlage angesponnen **22**

22) Sack deutlich konisch, vorderes Ende mit weicher Manschette ohne Belag, die ein- oder ausgestülpt sein kann (Abb. 24A-C) ***Manatha***

- Sack nahezu zylindrisch, nicht oder nur schwach konisch, ohne Manschette **23**

23) Sack kürzer als etwa 15 mm (Abb. 25) ***Proutia*, Stichobasis*, Sterrhopterix*,***
(senkrecht zur Unterlage, Abb. 26) ***Bacotia***

- Sacklänge 15–25 mm ***Acanthopsyche*, Sterrhopterix****

24) Fremdmaterial in Querrichtung zur Sackachse angesponnen. Dieser Punkt ist oft undeutlich bei Blattfragmenten oder Grashalmen, die gegen das hintere Sackende gerichtet, jedoch stark nach außen abstehend sind, im Zweifelsfall hier weiter suchen (Abb. 23A,F) **25**

- Kurze Fremdmaterial- Stücke sind in Längsrichtung am Sack angesponnen (Abb. 23B) **28**

25) Fremdmaterial quer, jedoch zufällig angeordnet. Ende wirr **26**

- Fremdmaterial quer, jedoch oft in nahezu perfekter Anordnung angebracht, Sackquerschnitt quadratisch (Abb. 7), Ende mit 4 Längskanten ***Amicta***

26) Ein mehr oder weniger dichtes Gespinst wird zur Verpuppung um den ganzen Sack, über das Fremdmaterial angebracht (Abb. 11B) ***Phalacropterix, Ptilocephala****

- Sack der Puppe ohne Gespinst (Abb. 11A) **27**

27) Sack zur Häutung und zur Verpuppung am vorderen Ende an Faden aufgehängt (Abb. 17A) ***Brachycyttarus****

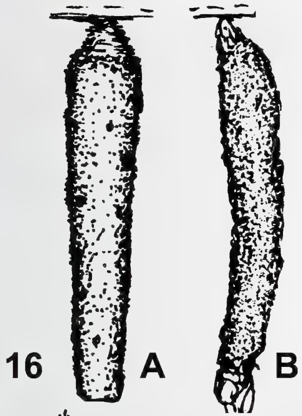
- Sack wird zur Häutung und zur Verpuppung am vorderen Ende direkt auf Unterlage angesponnen ***Megalophanes, Ptilocephala*, Aspina***

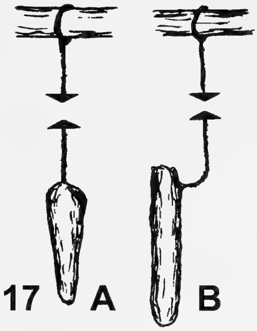
28) Sack kürzer als etwa 20 mm ***Reisseronia*, Ptilocephala****

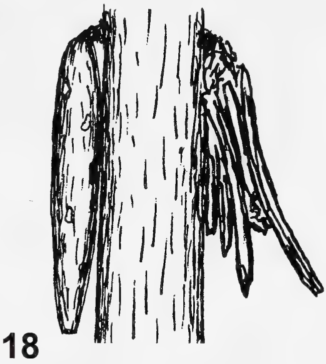
- Sack länger als etwa 20 mm (Abb. 9B+C) **29**

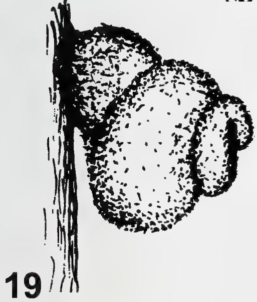
29) Belag aus meist flachen Grasstücken (Abb. 23B) ***Bijugis***

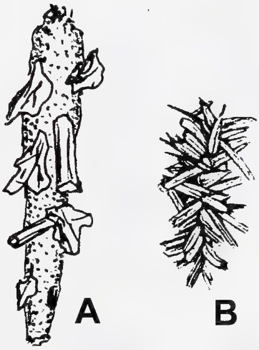
- Belag aus Grashalmen und Aststücken vermischt oder nur mit Blattfragmenten ***Acanthopsyche*, Oiketicoides, Bambalina, Canephora, Pachythelia, Auchmophila, Kotochalia, Leptopterix****











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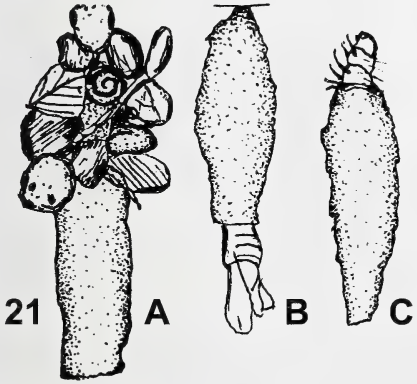

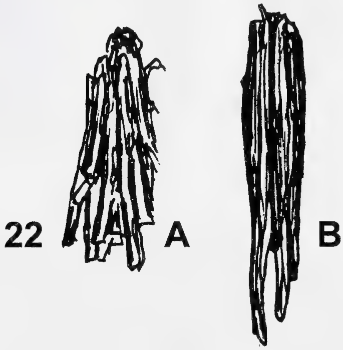

Abb. 16. Röhrenförmige Säcke, **A.** gerade, **B.** gebogen.

Abb. 17. Am Seidenfaden hängende Säcke der Metisinae, **A.** Faden axial, **B.** Faden seitlich angesetzt.

Abb. 18. Sack direkt auf Unterlage festgesponnen, links: *Chalioides* sp., rechts: *Bruandia comitella* (Bruand, 1853).

Abb. 19. Schneckenhausartig gewundener Sack von *Apterona* sp. Der Belag besteht meist aus feinem Sand oder Erde.

Abb. 20. Säcke mit unregelmäßig angeordnetem Pflanzenmaterial. **A.** *Loebelia crassicornis* (Staudinger, 1870). **B.** *Leptopterix plumistrella* ([Denis & Schiffermüller], 1775) (aus Hättenschwiler 1997).

Abb. 21 A. *Eumasia parietariella* (Heydenreich, 1851) **B.** *Luffia* sp., zur Verpuppung festgesponnener Sack mit Exuvie. C. *Luffia* sp., Sack mit Raupe.

Abb. 22. Längenverhältnisse von Fremdmaterial und Sack. **A.** *Psyche* sp., Fremdmaterial kürzer als Sack. **B.** *Epichnopterix* sp., Fremdmaterial länger als Sack.

30) Sack kürzer als etwa 20 mm **31**

- Sack länger als etwa 20 mm, Fremdmaterial: parallel längs angeordnete Halm- oder Zweigstücke ***Eumeta***

31) Fremdmaterial aus flachen Gräsern bestehend ***Epichnopterix***

- Fremdmaterial aus rundlichen Halmstücken oder Tannennadeln bestehend ***Psyche*, *Proutia**, *Bruandia*, *Penestoglossa*, *Peloponnesia*, *Reisseronia**, *Montanima*, *Heliopsychidea*, *Stichobasis**, *Whittlesia***

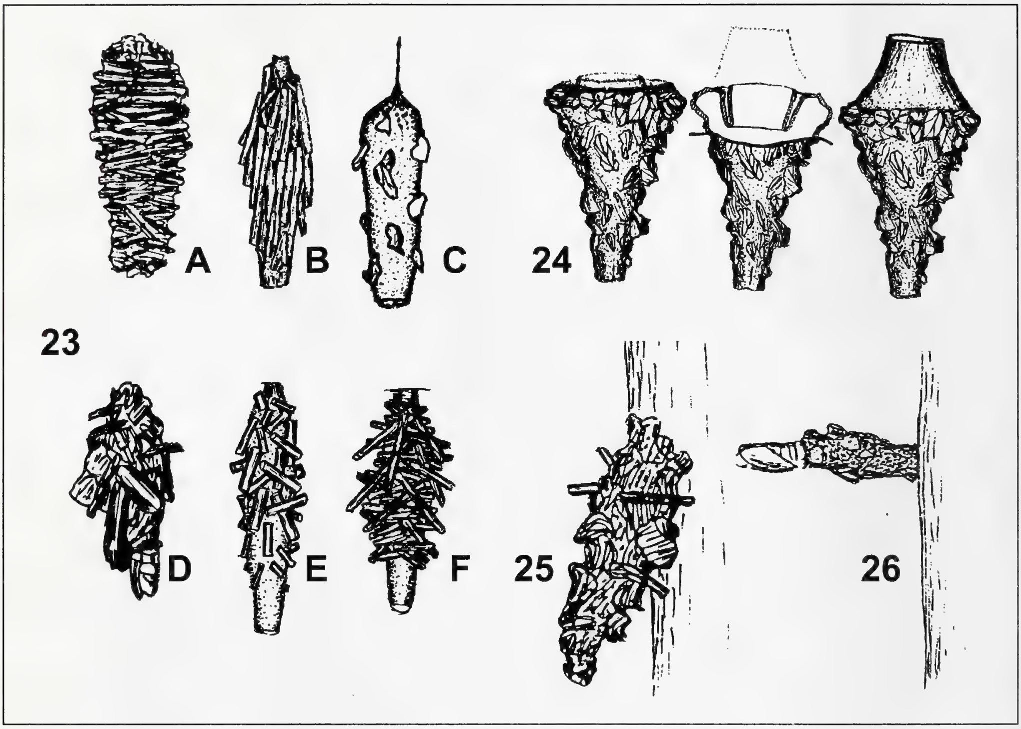

Abb. 23. Fremdmaterial kürzer als Sack. **A.** *Megalophanes* sp. **B.** *Bijugis* sp. **C.** *Metisa* sp. **D.** *Proutia betulina* (Zeller, 1839). **E.** *Acanthopsyche* sp. **F.** *Brachycyttarus* sp. (unterschiedliche Maßstäbe).

Abb. 24. Säcke der Gattung *Manatha* Moore, 1872. **A.** Vorderende eingestült. **B.** Vorderende aufgeschnitten. **C.** Vorderende ausgestülpt.

Abb. 25. *Proutia betulina*, Sack von Unterlage schräg abstehend.

Abb. 26. *Bacotia claustrella* (Bruand, 1845), Sack von Unterlage senkrecht abstehend.

Dank

Den Herren Walter Ettmüller (Bülach) und Hanspeter Wymann (Zollikofen) danken wir für die Originale der Abbildungen, die wir für die Abb. 2, 3, 13, 14 beziehungsweise 11B und 20B verwendet haben sowie den Herren Dr. Erwin Hauser (Wolfern, Österreich) und Ueli Kloter (Wetzikon) für die Durchsicht des Manuskriptes, die praktische Erprobung des Schlüssels und für die sehr wertvollen Hinweise und Ergänzungen.

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Book review

Christodoulos Makris 2003: Butterflies of Cyprus. – Bank of Cyprus Cultural Foundation, 329 pp. – Hardback (ISBN 9963-42-815-0) 29.50£ / 42.85 €; paperback (ISBN 9963-42-817-7) 25.95£ / 37.95 € (final price may vary due to postage, taxes, and handling costs).

Butterflies are by far the most popular insects among the order Lepidoptera. New regional butterfly books continue to be published even in regions like Europe where one might believe the fauna to be exhaustively covered. The present volume, nevertheless, is a very nice and beautifully produced addition. It is more a 'coffee-table book' rather than a scientific monograph. But for the first time all butterfly species known from the Mediterranean island of Cyprus have been illustrated in full colour, together with useful information on their distribution and ecology. The book is directed to the general nature lover rather than the butterfly specialist, and the text is written accordingly. The first chapters provide brief, non-technical introductions into the vegetation and climate of Cyprus, the morphology and life-cycles of butterflies, important behaviours, and natural enemies. The major part of the book is devoted to the 53 butterfly species known to occur on Cyprus, either as residents or (rare) immigrants. Each species is covered by a text of one printed page, accompanied by an impressive number of highest quality colour photographs of life butterflies and their early stages (usually three pages per species). For each species the recorded distribution on Cyprus is indicated on a grid map. The text gives important data on phenology and distribution. Larval host plants and major adult nectar sources are also listed, many of which for the first time. A brief synoptic chapter summarizes the butterfly fauna of Cyprus under the perspectives of biodiversity, biogeography, ecology, and conservation. To facilitate identifications, a second section of good quality plates depicts set specimens of all species in dorsal and ventral view, with appropriate consideration of sexual and seasonal polyphenism. Two indexes and a brief (one page) bibliography conclude the book. Overall, there is little to be critical with that book. The bibliography should probably have been a bit more comprehensive, but given the aim of the volume this is of rather marginal significance. The quality of the figures is near perfect, and the ecological and distributional information makes this a very valuable addition to the butterfly literature also for the advanced lepidopterist. The price of the book is adequate given the fine quality of printing and the lush illustrations. I confidently recommend this book to anyone interested in Mediterranean butterflies, and I wish this book wide distribution also among local authorities, naturalists and conservationists. Cyprus still has a remarkable, even though not too extensive butterfly fauna, and this book certainly has much potential in contributing to the preservation of this natural heritage.

KONRAD FIEDLER

Acanthopsyche muralis sp. n., ein parthenogenetischer Sackträger aus China und Überblick über die bekannten parthenogenetischen Arten der Psychidae

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Abstract. From a sample of Psychidae cases attached to the Great Wall of China, only females emerged which, without mating, produced fertile eggs from which we reared two generations. The specimens belong to a previously unknown parthenogenetic species described as *Acanthopsyche muralis* sp. n. The nine hitherto known parthenogenetic species of Psychidae are reviewed. For only four of them a bisexual form is known.

Zusammenfassung. Aus einer Aufsammlung von Psychiden-Säcken, welche an der Großen Chinesischen Mauer zur Verpuppung angesponnen waren, schlüpften nur Weibchen, welche ohne Paarung fertile Eier ablegten, die über zwei Generationen weiter gezüchtet wurden. Die Individuen gehören zu einer bislang unbekannten parthenogenetischen Art, die als *Acanthopsyche muralis* sp. n. beschrieben wird. Die neun bisher bekannten parthenogenetischen Arten der Psychidae werden besprochen. Nur von vier dieser Arten ist die bisexuelle Form bekannt.

Key words. Lepidoptera, Psychidae, parthenogenesis, review, *Acanthopsyche*, new species.

Einleitung

Während einer Geschäftsreise nach China im Juni 1980 besuchten mein Freund Hans Müller und ich zusammen mit unseren Chinesischen Freunden die Große Mauer. Dieses gewaltige Bauwerk erstreckt sich über viele hundert Kilometer Länge auf den Bergen nördlich von Peking von Osten nach Westen. Einst als Schutz gegen Eindringlinge aus dem Norden errichtet, wurden später Teile abgebrochen und als Baumaterial verwendet. Auf dieser Mauer verläuft eine Strasse von unterschiedlicher Breite, mindestens aber so breit, dass drei Reiter nebeneinander reiten konnten. Auf beiden Seiten dieser Strasse sind Mauern, die gegen Süden etwa brusthoch, gegen Norden aber deutlich höher sind. In der oberen Hälfte sind zur Beobachtung und Verteidigung fensterartige Lücken ausgespart. In diesen Lücken fanden wir einzelne angesponnene Kokons der Spinnerart *Dendrolimus segregatus* f. cinerea Seitz, 1913 sowie eine größere Zahl von Psychiden-Säcken. Diese waren an einzelnen Stellen der Mauersteine so zahlreich, dass oft zwei bis drei zusammen gesponnen waren. Vermutlich haben sich über die Jahre an geeigneten Stellen die Säcke verschiedener Generationen angesammelt.

Zu Hause schlüpften aus den 32 gesammelten Säcken lediglich drei Weibchen vom 14.–18. Juli 1980. Sie streckten abends den Kopf aus dem Sack und zeigten das für die Arten von *Acanthopsyche* Heylaerts, 1881 typische Lockverhalten. Dieses wurde gegen Mitternacht abgebrochen und der Eivorrat in die Puppenhülle im Sack abgelegt. Aus diesen ohne Paarung abgelegten Eiern zogen wir zwei Generationen und erhielten insgesamt etwa einhundert Weibchen, jedoch kein Männchen.

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Acanthopsyche muralis sp. n.

Material. Holotypus ♀ **China**, Provinz Hebei, Badaling, 700 m, 9.vi.1981 (e. o., erste Nachzucht), mit Sack, leg. et cult. Hättenschwiler, coll. Naturmuseum Luzern. Paratypen: 3♀ gleiche Daten, aber e. p. 5., 14., 17.vii.1980 (e. p.), 28 Säcke, 1 Larve 20.8.1980; 1. Nachzucht: 87♀ mit Säcken, 6.vi.–8.vii.1981 (ex. o.), 2 Larven; 2. Nachzucht: 9♀ mit Säcken, 4.–7.vii.1982 (e. o.); coll. E. Hauser, R. & P. Hättenschwiler, H. Henderickx, R. Herrmann, E. V. Rutjan, Academia Sinica Beijing, Entomologische Sammlung ETH Zürich, Museum für Tierkunde Dresden, Muséum d'histoire naturelle Genf, Naturhistorisches Museum Basel, Museum Witt München, National Museum of Natural History Washington, Nationaal Natuurhistorisch Museeum Leiden, Natur Museum Luzern, Natural History Museum London, Zoological Museum Kopenhagen.

Beschreibung ♀. Körper zylindrisch, 8–10 mm lang, 1,6–2 mm Durchmesser, blaßgelblich, feinhäutig, die Eier sind durch die dünne Haut sichtbar (in der Zucht einige Weibchen nur etwa 6 mm lang, bei 1,3 mm Durchmesser). Afterwollkranz und Körperbehaarung nur sehr schwach ausgeprägt und kaum sichtbar; Haare weißlich, sehr dünn, die meisten werden beim Schlupf abgeschabt und verbleiben in der Exuvie oder im Sack. Augen bestehen aus wenigen dunklen Punkten, sie scheinen funktionslos zu sein; Antennen sind auf einen eingliedrigen Stummel reduziert. Beine stark reduziert, aus eingliedrigen feinen Wülsten bestehend, funktionslos. Kopf und Brustsegmente stärker sklerotisiert, dunkler gelb-bräunlich gefärbt (Abb. 1A). Legeröhre kurz, wenig sklerotisiert, ventral davon liegt die Geschlechtsöffnung, welche schwach sklerotisiert und ohne Bedornung ist, sie ist durch die zweilappige Subgenitalplatte geschützt (Abb. 1B); im Inneren des 8. Segmentes liegende Teil der Legeröhre stärker sklerotisiert, beidseitig gegen die Kopfseite zu verlängert.

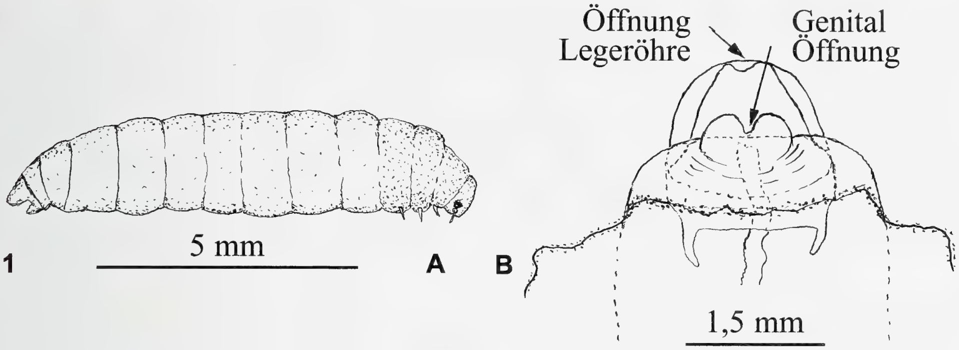
Eier. Blaßgelb, oval, während der Reifung werden sie dunkler, ohne Strukturen. Ein Weibchen legt etwa 150–200 Eier, die Zahl ist von der Größe des Weibchens abhängig. Oft wird die Eiablage beendet, obwohl noch bis zu 10 Eier im Körper zurück bleiben.

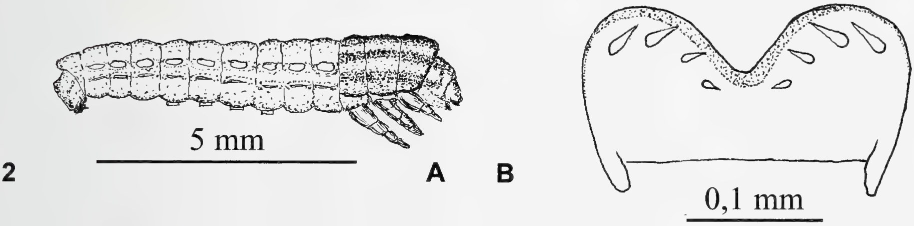
Raupen. Erwachsen 7–10 mm lang bei einem Durchmesser von 1,2–1,6 mm (Abb. 2A), Kopf mit heller und brauner Zeichnung, Brustschilder dunkelbraun, dorsal mit fünf cremegelben Längsstreifen, Abdomen rötlich bis gelbbraun. Labrum ventral beidseitig mit vier Dornen (Abb. 2B).

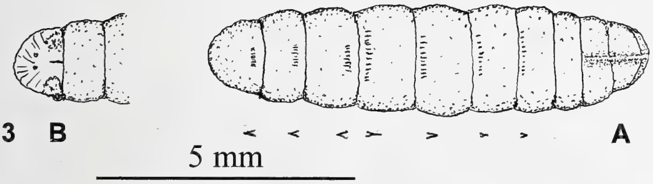
Säcke. Der Sack besteht aus Seide, ist außen mit Pflanzenfragmenten besponnen, die kürzer als die Sacklänge sind und längs bis quer zur Längsachse des Sackes anliegend befestigt sind, an der hinteren Öffnung abstehend. Sack 13–20 mm lang, ohne die abstehenden Halmstücke etwa 4–5 mm im Durchmesser (Abb. 4 A–C).

Puppe. 8–10 mm lang, 1,5–2 mm Durchmesser, vor dem Schlüpfen dunkel, leere Hülle hellbraun. Kopfplatte mit stark reduzierten und verschmolzenen Scheiden mit vier Borstenpaaren. Obwohl die Puppe den Sack nie verlässt, trägt sie die vor- und rückwärts gerichteten dorsalen Dornenreihen, die das Verschieben der Puppe in beide Richtungen erlauben würde (Abb. 3).

Lebensweise. Das Schlüpfen der Weibchen findet im Juni bis Juli am späten Nachmittag bis zum Eintreten der Dunkelheit statt. Dabei wird der Kopf ein kleines Stückchen aus der hinteren Sacköffnung gestreckt. Das ist das gleiche Verhalten wie bei den bisexuellen Arten der Gattung *Acanthopsyche*, wenn das Weibchen den Lockduft aussendet, um den Männchen die Kopulationsbereitschaft bekannt zu geben. Wenn dann aber bis gegen Mitternacht keine Kopula stattgefunden hat, zieht







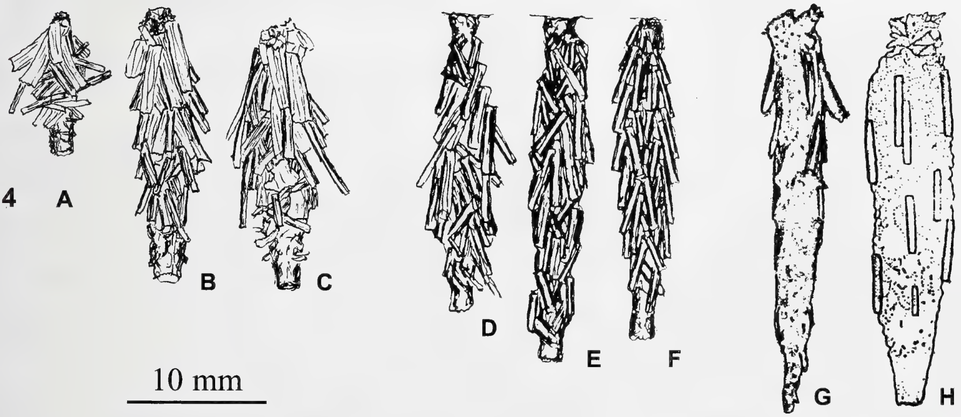


Abb. 1. *A. muralis*, ♀. **A.** Seitenansicht. **B.** Abdomen mit Genitalapparat von ventral betrachtet, die zweilappige Subgenitalplatte verdeckt die Geschlechtsöffnung.

Abb. 2. *A. muralis*, Raupe. **A.** Seitenansicht. **B.** Ventralansicht des stark vergrößerten Labrums mit beiderseits vier Dornen.

Abb. 3. *A. muralis*, Puppenhülle. **A.** Dorsalansicht; die Pfeile neben der Puppe zeigen die Richtung der dorsalen Dornenreihen. **B.** Ventralansicht der letzten Abdominalsegmente.

Abb. 4. ♀ Raupensäcke. **A.** *A. muralis*, Jugendsack vor der Überwinterung. **B–C.** *A. muralis*, Säcke erwachsener Raupen. **D–E.** *A. nigraplaga* von Peking. **F.** *A. nigraplaga* von Nanjing. **G.** *A. bipars* von Nepal (nach Dierl, 1966). **H.** *A. bipars* aus China (nach Chung-Ling 1982) (alle Abbildungen im gleichen Maßstab).

sich das Weibchen in die Puppenhülle zurück, die noch ganz im Sack liegt und legt bis zum Morgen den Eivorrat in die Puppenhülle. Das Weibchen besteht nun fast nur noch aus Außenskelett und stirbt in der Puppenhülle. Ohne dass eine Paarung stattgefunden hat, schlüpfen nach etwa 2–3 Wochen die jungen Raupen. Sie verlassen den mütterlichen Sack und beginnen sogleich mit dem Bau eines kleinen Sackes, der dann während des ganzen Lebens vergrößert und wenn notwendig auch repariert wird. Als erstes Baumaterial werden oft Teile des Muttersackes verwendet. Dann lassen sich die Raupen zu Boden fallen, wo sie ihr erstes Futter finden. Die Raupen ernähren sich von verschiedenen niederen Pflanzen, sie bleiben meistens in Bodennähe. Im August bis September sind die Säcke 10–12 mm lang und die Raupe beginnt die Winterruhe, die bis etwa April bis Mai dauert. Dazu wird der Sack an Pflanzen oder festen Gegenständen mit einem Faden fixiert. Im Frühling beginnt die Raupe nochmals zu fressen und der Sack wird auf die endgültige Größe von bis zu 20 mm Länge ausgebaut. Nach der Überwinterung wird das Fremdmaterial in Längsrichtung angesponnen, oft werden einzelne längere Grashalmstücke vorn am Sack so befestigt, dass sie gegen das hintere Sackende weit abstehen und den Säcken ein eher ungeordnetes Aussehen geben. Ende Mai bis Anfang Juni sind die Raupen erwachsen, steigen in die Höhe und spinnen den Sack fest, vorzugsweise an soliden Halmen aber auch Pfosten, Steinen oder Mauern.

Verbreitung. Bislang nur von Badaling nördlich Beijing bekannt.

Beobachtete Parasitoide. Aus den gefundenen Säcken zogen wir neben den drei Weibchen und einer Raupe folgende Parasitoide: Diptera, 1Ex., 5.vii.1980 (e. p.); Hymenoptera, Eulophidae, Pteromalidae, Pteromalinae, *Dibrachys* sp., 12 Ex. 24.vii.1980 (e. p.), det. H. Baur; Hymenoptera, Ichneumonidae, Cryptinae, Cryptini, 1 Ex., 16.vii.1980 (e. p.); Hymenoptera, Ichneumonidae, Cryptinae, Phygadeuontini, 2 Ex. 11.–12.ii.1981 (e. l.), det. P. Schmid.

Derivatio nominis. Die Art ist nach ihrem Auffinden an der "Großen Mauer" (Lateinisch für Mauer: murus) benannt.

Diagnose. *A. muralis* ist nach der Morphologie des Weibchens und des Sackes den Weibchen der palaearktischen Gattung *Acanthopsyche* sehr ähnlich und wird daher provisorisch in dieser Gattung beschrieben, da genauere charakteristische Merkmale, z. B. der Männchen, nicht bekannt sind. Alle der *A. muralis* verwandten Arten sind größer und unterscheiden sich im äußeren Sackbelag. Die Weibchen-Säcke der europäischen *A. atra* (Linnaeus, 1767) sind 19–25 mm lang, mit feinen Pflanzenfragmenten belegt, nur wenige kurze Grasstücke werden verwendet. Die *A. atra*-Weibchen sind mit 9–12 mm Länge und 2,5–3 mm Durchmesser ebenfalls größer als jene der *A. muralis*. Die Säcke der in China vorkommenden *A. bipars* (Walker, 1865) und *A. nigraplaga* (Wileman, 1911) sind längs mit pflanzlichem Material belegt. *A. nigraplaga*-Säcke sind 22–27 mm (Abb. 4 D–F), *A. bipars*-Säcke 30–34 mm lang und schwächer belegt (Abb. 4 G, H). Dagegen sind die Säcke von *A. muralis* sp. n. nur 13–20 mm lang, die Grasteile z. T. nicht anliegend, sie erscheinen "struppig" (Abb. 4 A–C). Genauere Beschreibungen der Weibchen jener Arten fehlen bislang, so dass eine detaillierte Differentialdiagnose noch nicht vorgenommen werden kann. Diese Befunde schließen aus, dass es sich bei *A. muralis* um eine parthenogenetische Form einer der genannten Arten handeln könnte. So erwähnen Forster & Wohlfahrt

(1960: 158), dass bei *A. atra* zuweilen parthenogenetische Entwicklung vorkommt, doch ist dies bislang nicht weiter bestätigt worden.

Bemerkungen zu den parthenogenetischen Arten

Bis heute sind mir zehn Arten von Psychiden bekannt, deren Weibchen sich ohne Begattung fortpflanzen können, also parthenogenetisch sind. Diese 10 Arten verteilen sich auf fünf verschiedene Unterfamilien (System nach Hättenschwiler 1989; Sauter & Hättenschwiler 1991):

Zuerst beschriebene Form, die als Art betrachtet wird	**Später beschriebene Form der gleichen Art**	**Vorkommen**
Naryciinae		
Dahlica triquetrella (Hübner, 1813) ♂	f. parth. ♀	Europa, Kanada
Dahlica lichenella (Linnaeus, 1761) ♀	f. fumosella (Heinemann, 1870) ♂	Europa, Kanada
Dahlica parthenogenensis (Saigusa, 1961) ♀		Japan
Dahlica fennicella (Suomalainen, 1980) ♀		Finnland
Scoriodytinae		
Scoriodyta virginella Hättenschwiler, 1989 ♀		Neuseeland
Scoriodyta virginella f. minima Hättenschwiler, 1989 ♀		Neuseeland
Psychinae		
Luffia lapidella (Goeze, 1783) ♂	f. ferchaultella (Stephens, 1850) ♀	Europa
Epichnopteriginae		
Reisseronia gertrudae Sieder, 1962 ♀	*Reisseronia gertrudae* Sieder, 1962 ♀	Europa
Oiketicinae		
Acanthopsyche muralis ♀		China
Apterona helicoidella (Vallot, 1827) ♀	f. crenulella (Bruand, 1853) ♂	Europa, USA, Kanada

Dahlica triquetrella (Hübner, 1813) wurde aufgrund des Männchens beschrieben. 1859 hat Hofmann den experimentellen Beweis für die Zusammengehörigkeit der bisexuellen und der parthenogenetischen Form erbracht. Das Weibchen ist in einer diploiden und einer tetraploiden Form verbreitet (Seiler 1946; Sauter 1956). Alle leben an Algen und Flechten die an Stein und Holz wachsen. Die parthenogenetischen Weibchen sind über ganz Europa verbreitet aber auch im südlichen Teil Kanadas von Quebec bis British Columbia. Ob die Art von Europa dorthin eingeschleppt wurde ist nicht klar. Die Ausbreitung in Kanada ist ganz beträchtlich, was auf eine weit zurück liegende Besiedlung schließen lässt.

Dahlica lichenella (Linnaeus, 1761). Linné hat nur die parthenogenetischen Weibchen gekannt und beschrieben. Erst 1958 erkannte Sauter *Solenobia fumosella* Heinemann, 1870 als die bisexuelle Form von *Dahlica lichenella*. Beide Formen sind in Europa weit verbreitet. In der Schweiz ist die parthenogenetische Form häufig, die bisexuelle Form hingegen ist nur von wenigen Standorten bekannt; in Skandinavien ist das Verhältnis etwa umgekehrt. Im Gebiet von British Columbia im westlichen Kanada ist die parthenogenetische Form ebenfalls verbreitet, die bisexuelle Form wurde dort jedoch nicht nachgewiesen. Die Raupen leben meistens von Algen und Flechten an Stein und Holz, häufig an feuchten Stellen. Zu dieser Art gehört wohl auch *Solenobia norvegica* Strand, 1919.

Dahlica parthenogenensis (Saigusa, 1961). Bei dieser Art ist nur das parthenogenetische Weibchen bekannt, das in Honshu und Kyushu (Japan) gefunden wurde. Nahe Verwandtschaft mit einer bisexuellen Art konnte noch nicht nachgewiesen werden.

Dahlica fennicella (Suomalainen, 1980). Das parthenogenetische Weibchen ist aus dem Süden von Finnland beschrieben. Ein Vorkommen in anderen Gebieten ist nicht bekannt, auch kennt man keine bisexuelle Form. Als Nahrung werden Algen und Flechten, besonders an Steinen, seltener an Holz verwendet (Suomalainen, 1980).

Scoriodyta virginella Hättenschwiler, 1989. Das parthenogenetische Weibchen ist auf dem ganzen Gebiet der Nordinsel von Neuseeland anzutreffen, in der Regel an Algen und Flechten, die auf Steinen leben. Es konnte noch nicht geklärt werden, ob eine der einheimischen, bisexuellen *Scoriodyta*-Arten mit *S. virginella* verwandt ist.

***Scoriodyta virginella* f. minima** Hättenschwiler, 1989. Diese parthenogenetische Form unterscheidet sich von der voran gegangenen Art durch die Kleinheit der Weibchen und deren Säcke, die recht konstant ist. Die Form ist ebenfalls auf der ganzen Nordinsel von Neuseeland gefunden worden, meistens an Steinflechten und Algen.

Luffia lapidella (Goeze, 1783) und die parthenogenetische **f. ferchaultella** (Stephens, 1850). Die bisexuelle *L. lapidella* ist in Mitteleuropa weit verbreitet, in der Schweiz in den Südtälern der Alpen, vorwiegend an trockenen Mauern, Felsen und an Holz, wo sie an Algen, Flechten und Moosen leben. An schattigeren Stellen im Tessin in der Süd-Schweiz leben Populationen, die wenig Männchen produzieren aber nicht parthenogenetisch sind. Frau Narbel-Hofstetter, 1956 nennt sie "pseudogamisch". Die parthenogenetische Form ferchaultella (Stephens, 1850) ist in Europa verbreitet. Im Mittelmeergebiet ist sie wohl von den alten Seefahrern mit Transporten über viele Inseln von Kreta bis auf die fernen Azoren im Atlantik (Henderickx 1997) verbreitet worden.

Reisseronia gertrudae Sieder, 1962. Das parthenogenetische Weibchen ist vom Originalfundort im Sausalgebiet und einigen weiteren Fundorten in der Südsteiermark bekannt. Sie lebt dort von verschiedenen niederen Pflanzen in einer Wiese mit Obstbäumen oder in Halbtrockenrasen.

Acanthopsyche muralis sp. n. Von dieser Art kennen wir die parthenogenetischen Weibchen, die nördlich von Beijing in China gefunden wurden. Sie ernähren sich von verschiedenen niederen Pflanzen.

Apterona helicoidella (Vallot, 1827) und **f. bisex. crenulella** (Bruand, 1853). Beide Formen, die parthenogenetische *helicoidella* und die bisexuelle Form crenulella sind in Europa weit verbreitet, vom Atlantik bis Rußland und vom Mittelmeer bis Skandinavien. Die jungen, im Juli aus dem Ei geschlüpften Raupen verbleiben im mütterlichen Sack bis zum nächsten Frühling. Wenn während dieser langen Zeit der Sack zusammen mit dem Holz oder Stein an dem er angesponnen ist verfrachtet und wieder abgelagert wird, kann leicht eine neue Population entstehen. Davis (1954) und Wheeler &. Hoebeke (1988) berichten ausführlich über die Einschleppung und Verbreitung in den USA und Kanada. Hättenschwiler (1997: 304) erwähnt ein Beispiel einer solchen Verbreitung über Bäche und Flüße. Alle diese Beispiele bereffen die parthenogenetische Form, bei der eine einzelne Raupe eine neue Population gründen kann.

Danksagung

Auch bei dieser Arbeit durfte ich von der Beratung und Hilfe durch meinen Freund Prof. Dr. Willi Sauter profitieren und möchte ihm dafür bestens danken. Vielen Dank den Herren Dr. Hannes Baur und Peter Schmid für das Bestimmen der Parasitoiden Wespen und meiner lieben Frau Ruth für die Hilfe und Betreuung der Zuchten.

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Four new species of *Gnorismoneura* from China (Tortricidae)

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Abstract. Four species of the genus *Gnorismoneura* Issiki & Stringer, 1932 are described from China: *G. grandiprocessa* sp. n., *G. cylindrata* sp. n., *G. serrata* sp. n. and *G. quadrativalvata* sp. n. The females of *G. taeniodesma* (Meyrick, 1934) and *G. zetessima* Razowski, 1977 are first reported. A key to all the described species is provided and the geographical distribution is shown in a map. The genital structures of the new species are illustrated.

Key words. Lepidoptera, Tortricidae, *Gnorismoneura,* new species, China.

Introduction

The genus *Gnorismoneura* Issiki & Stringer, 1932 (type species *G. exulis* Issiki & Stringer, 1932 by original designation) belongs to Ramapesiini, Tortricinae. The species of the genus are mainly distributed in East Asia except for *G. prochyta* (Meyrick, 1908) distributed in India. Razowski revised the genus with 13 species reported in 1977 and redescribed the genus in 1987. The species of the Palaearctic Region were catalogued by the same author (Razowski 1993). Up to date, 11 species from China (Razowski 1977, 1993; Kawabe 1992; Liu 2002), two species from Korea (Byun 1998), four species from Japan (Yasuda 1972, 1975; Kawabe 1982) and one species from Far East of Russia (Kuznetsov 2001) were reported.

In the present paper, the geographical distribution of the described species of the genus is provided (Fig. 1) based on the known data. Four species are described as new to science, and the females of *G. taeniodesma* (Meyrick, 1934) and *G. zetessima* Razowski, 1977 are reported for the first time. All the studied specimens, including the types, are deposited in the Department of Biology, Nankai University, Tianjin, China.

Key to species of *Gnorismoneura* based on male genital characters

1. Transtilla with large bifurcate median process **2**
– Transtilla without large bifurcate median process **3**

2. Uncus long, with a pair of sharp lateral processes; gnathos with long lateral processes ***G. zyzzogeton***
– Uncus short and very broad, distinctly expanded terminally; gnathos with short lateral processes ***G. orientis***

3. Gnathos without distinct lateral processes **4**
– Gnathos with distinct lateral processes **7**

4. Uncus slender, tapering distally; aedeagus very long, with a long curved dorsal process ***G. vallifica***
– Uncus short, expanded distally; aedeagus short **5**

5. Sacculus with submedian prominence ventrally ***G. taeniodesma***
– Sacculus normal, without distinct prominence **6**

6. Socius small; uncus not broadened distally ***G. prochyta***
– Socius large; uncus broadened distally ***G. mesoloba***

7. Gnathos with short lateral processes **8**
– Gnathos with very long lateral processes **14**

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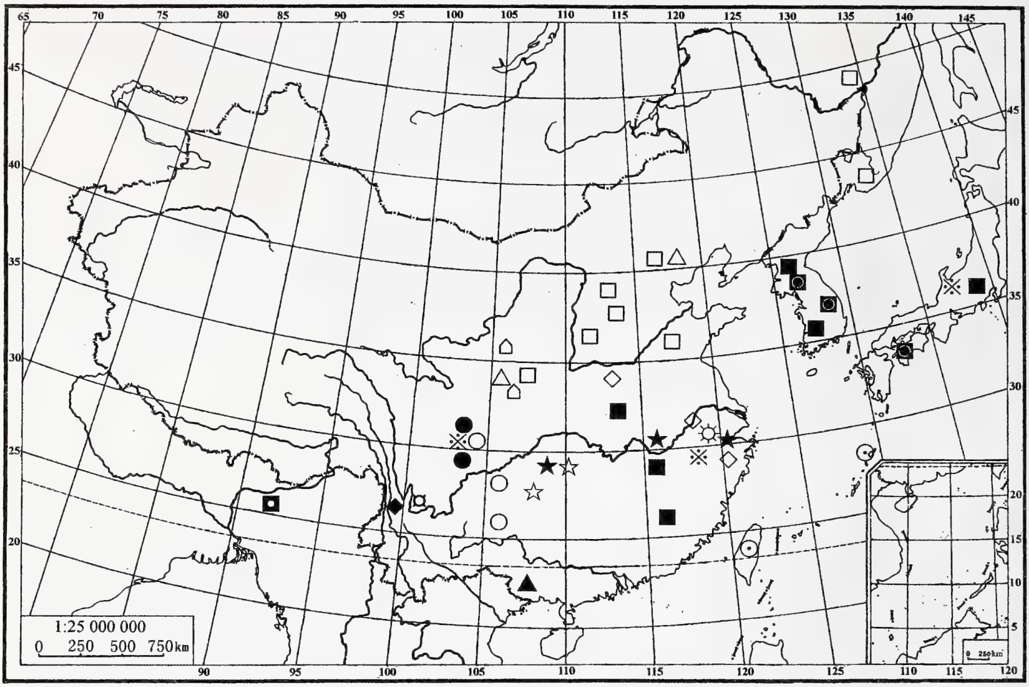


Fig. 1 Distribution of the genus *Gnorismoneura* spp.

Lengend: ◘ *G. prochyta* (MEYRICK); ▣ *G. mesotoma* (YASUDA); ⦿ *G. exulis* ISSIKI & STRINGER; ■ *G. hoshinoi* (KAWABE); ◆ *G. mesoloba* (MEYRICK); ¤ *G. micronca* (MEYRICK); □ *G. orientis* (FILIPEV); ● *G. stereomorpha* (MEYRICK); ○ *G. taeniodesma* (MEYRICK); ☼*G. tragoditis* (MEYRICK); ※ *G. vallifica* (MEYRICK); ⌂ *G. zetessima* RAZOWSKI; ◇ *G. zyzzogeton* RAZOWSKI; ☆*G. grandiprocessa* sp. n.; ★*G. cylindrata* sp. n.; ▲ *G. serrata* sp. n.; △ *G. quadrativalvata* sp. n.

8. Uncus with a pair of lateral processes; sacculus provided with a bunch of setae submedially and bristles terminally. ***G. hoshinoi***
– Uncus without lateral processes; sacculus normal **9**

9. Aedeagus short, with dense denticles beyond middle ***G. tragoditis***
– Aedeagus without dense denticles beyond middle **10**

10. Transtilla folded in middle; sacculus with submedian prominence ventrally ***G. exulis***
– Transtilla without fold in middle; sacculus without prominence ventrally **11**

11. Sacculus with carina at end ***G. stereomorpha***
– Sacculus without carina at end **12**

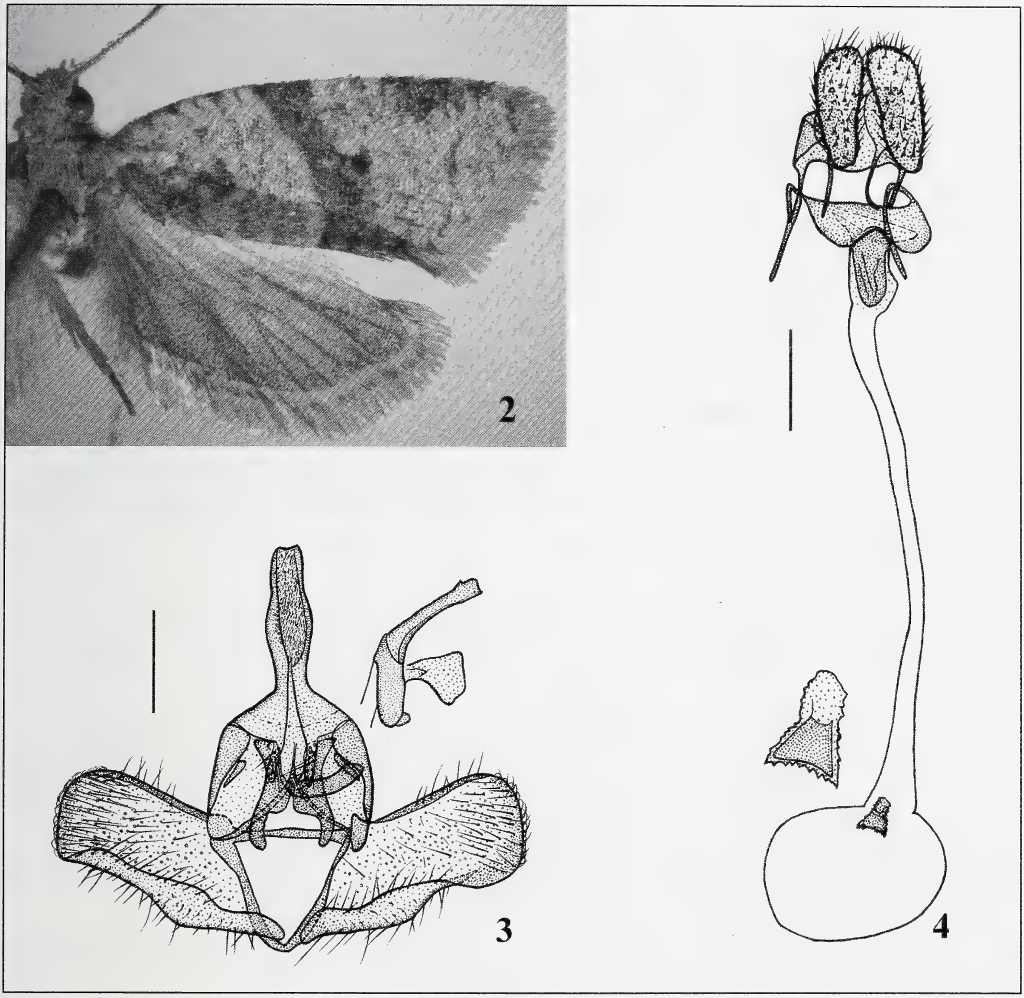
12. Aedeagus broad, without carina, with large lateral prominences of coecum penis ***G. micronca***
– Aedeagus slender, with carina, but without prominences of coecum penis **13**

13. Uncus rounded apically; aedeagus with dorso-lateral carina subterminally ***G. mesotoma***
– Uncus concave apically; aedeagus with dorsal and ventral carina terminally ***G. zetessima***

14. Aedeagus with a large upward dorsal carina at middle; sacculus provided with a sharp ventral process at middle. ***G. serrata* sp. n.**
– Aedeagus without dorsal process at middle; sacculus without vental process **15**

15 Uncus concave apically; sacculus broad ***G. grandiprocessa* sp. n.**
– Uncus rounded apically; sacculus narrow **16**

16. Sacculus narrow, provided with a sharp termination; valva quadrate; aedeagus with small dorsal carina subapically ***G. quadrativalvata* sp. n.**
– Sacculus without sharp termination; valva broad, somewhat broadened distally; aedeagus provided with a small ventral prominence subapically ***G. cylindrata* sp. n.**



Figs. 2–4. *Gnorismoneura grandiprocessa* sp. n. **2.** Adult. **3.** Male genitalia. **4.** Female genitalia (reference bar 0.5 mm).

Gnorismoneura grandiprocessa sp. n. (Figs. 2–4)

Material. Holotype ♂, **China**: Guizhou Province, Jiangkou County: Mt. Fanjing [27°55'N, 108°41'E], 1700 m, 29.vii.2002, Hou-Hun Li and Xin-Pu Wang leg., genitalia slide No. WXP02259. – Paratypes: 2♀, same data as holotype; ♂, 2♀, same data as holotype, but Mt. Fanjing, 2100 m, 30.vii.2002; 2♂, 9♀, same data as holotype, but Mt. Fanjing, 1300 m, 1.–3.viii.2002; 5♂, 6♀, Hunan Province, Sangzhi County, [29°23'N, 110°41'E], 1250 m, 12.–13. viii. 2002, Hou-Hun Li and Xin-Pu Wang leg.

Adult (Fig. 2). Wingspan 12.0–13.5 mm in male, 15.0–17.5 mm in female. Frons and vertex with erect and rough yellowish scales. Labial palpus dark brown, 1.5 times shorter than diameter of compound eye, third segment thin. Antenna short, ciliate. Tegula developed, brown. Thorax brown. Costa of forewing convex in basal third, then straight, with costal strigulae. Apex short and blunt. Termen oblique and straight. Ground color of forewing yellowish brown; patterns dark brown: basal blotch ambiguous, scattered with brown scales, provided with a small black dot; median fascia extending from $^1/_3$ of costa to dorsum, broad posteriorly, with a black dot at middle of outside; subapical blotch subtriangular; cilia pale yellowish. Hindwing dark gray, cilia pale gray. Legs whitish yellow; outer side of foreleg, tibia of midleg black, inner side pale yellowish. Abdomen dark brown dorsally, pale yellowish ventrally.

Male genitalia (Fig. 3). Tegumen broad, lateral sclerite narrow. Uncus large, median part expanded, then distinctly narrowed, somewhat concave apically, with strong bristles distally. Socius slender. Gnathos with dilated termination and strong lateral processes. Transtilla band-like, broadened laterally. Valva broad, costa developed. Sacculus broad, with broad median part. Aedeagus curved, provided with a small dorsal carina subapically.

Female genitalia (Fig. 4). Papilla analis broad. Apophysis posterior with broad basal plate. Lateral portion of sterigma broad. Antrum broad, provided with internal sclerite. Signum a small plate, provided with serrate margin and lateral processes.

Diagnosis. The new species is closely related to *G. zetessima* Razowski, but it can be separated from the latter by the following characters of the male genitalia: (1) Uncus with distinctly narrow portion; (2) Gnathos with strong lateral processes; (3) Sacculus obviously expanded at middle.

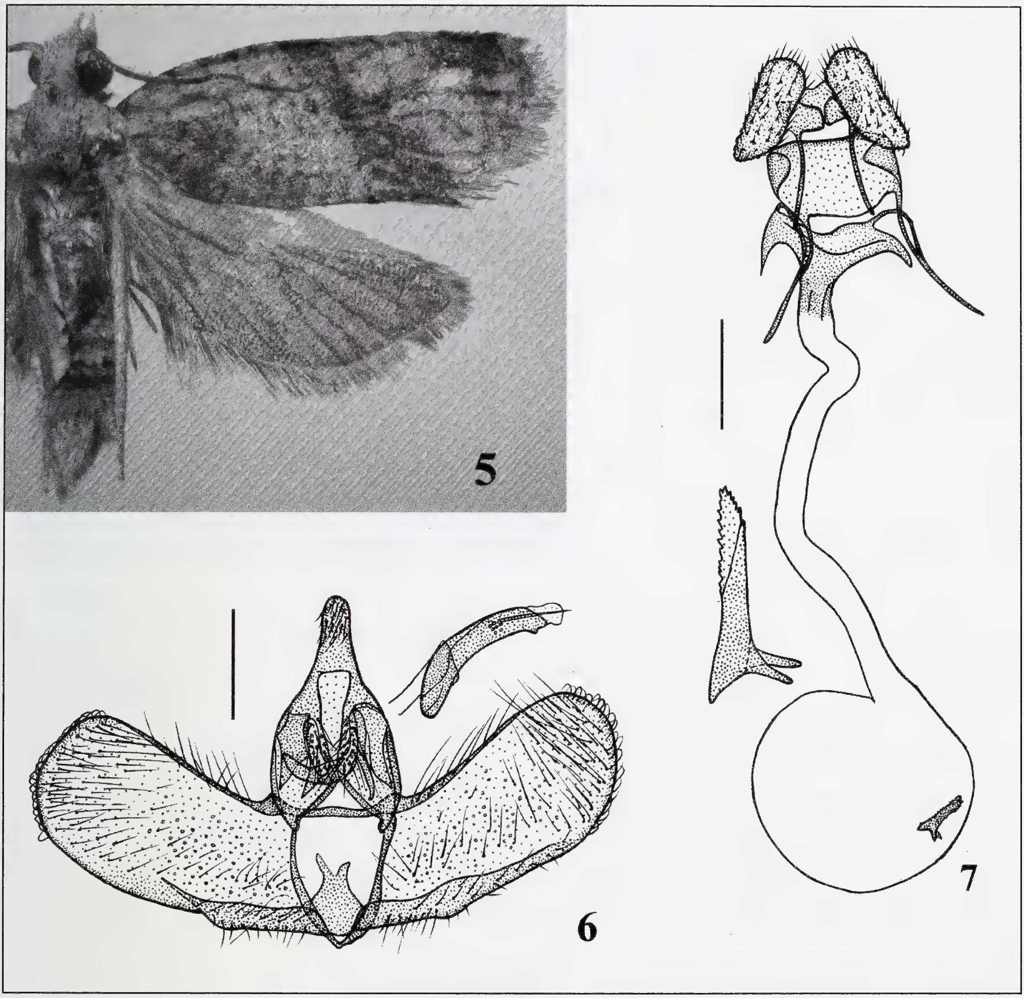
Derivatio nominis. The specific name is derived from the Latin words *grandis* (large), and *processus* (process), indicating the large lateral processes of gnathos.

Gnorismoneura cylindrata sp. n. (Figs. 5–7)

Material. Holotype ♂, **China**: Zhejiang Province, Mt. Tianmu [30°26'N, 119°34'E], 1500 m, 18.viii.1999, Hou-Hun Li et al. leg. – Paratypes: 12♂, 20♀, same data as holotype; 12♂, 6♀, same data as holotype, but 1140 m, 17.viii.1999; 2♂, 8♀, Hubei Province, Wufeng County [30°12'N, 116°40'E], 800 m, 12.–19.viii.1999, Hou-Hun Li et al. leg.; ♀, Hubei Province, Xianfeng County [29°40'N, 109°08'E], 1280 m, 20.vii.1999, Hou-Hun Li et al. leg.

Adult (Fig. 5). Wingspan 12.0–13.5 mm in male, 15.0–18.0 mm in female. Vertex with erect and rough yellow scales. Labial palpus slender, pale yellowish, 1.5 times shorter than diameter of compound eye. Antenna thin. Tegula yellowish. Thorax brown. Costa of forewing convex basally, with some strigulae. Apex short. Termen oblique and straight. Ground color of forewing yellowish brown; patterns dark brown: basal blotch large; median fascia from middle of costa to dorsum, basal half expanded; subapical blotch large; cilia pale gray. Hindwing dark gray, cilia pale gray. Legs whitish yellow; outer side of tarsus of foreleg and midleg with black scales. Abdomen dark brown dorsally, yellowish ventrally.

Male genitalia (Fig. 6) Tegumen broad, lateral sclerite large, erose. Uncus broad basally, columniform distally. Socius large. Gnathos with long termination; lateral processes slender, sharp apically. Transtilla band-formed, somewhat broadened laterally. Valva broad, distal half slightly expanded; costa developed. Sacculus narrow, broadened at middle. Juxta forked apically. Aedeagus stout, provided with a small ventral prominence subapically; caulis and coecum penis short; vesica with a cornutus and a group of seven sclerotized sockets pointing to deciduous cornuti.



Figs. 5–7. *Gnorismoneura cylindrata* sp. n. **5.** Adult. **6.** Male genitalia. **7.** Female genitalia (reference bar 0.5 mm).

Female genitalia (Fig. 7). Papilla analis broad. Apophysis posterior with broad basal plate. Lateral portion of sterigma narrow. Antrum broad, sclerotized weakly. Signum slender, provided with pointed lateral processes.

Diagnosis. The new species is similar to *G. vallifica* (Meyrick), but it can be easily separated from the latter by the following features: (1) Gnathos of the new species with long lateral processes, while gnathos of the latter species without them; (2) Aedeagus stout, provided with a small ventral prominence subapically, but aedeagus of the latter species slender; (3) Signum present in the new species, but absent in the latter species.

Derivatio nominis. The specific name is derived from the Latin word *cylindratus* – columniform, referring to the form of the uncus.

Gnorismoneura serrata sp. n. **(Figs. 8–10)**

Material. Holotype ♂, **China**: Guangxi Province, Shangsi County [22°09'N, 107°58'E], 510 m, 6.iv.2002, Shu-Lian Hao and Huai-Jun Xue, leg., genitalia slide No. WXP02406. – Paratypes. 5♂, 2♀, same data as holotype.

Adult (Fig. 8). Wingspan 14.0–16.5 mm in male, 18.0–19.5 mm in female. Vertex with rough yellow scales. Labial palpus slender, pale yellowish, 1.5 times shorter than diameter of compound eye. Antenna thin. Tegula developed, yellowish brown. Thorax dark brown. Apex short and blunt. Termen oblique and straight. Forewing broad, ground color yellowish brown, scattered with some short strigulae; patterns black: basal blotch absent; median fascia stretching from middle of costa to dorsum, expanded posteriorly; subapical blotch large; cilia pale gray. Hindwing dark gray, cilia pale. Legs whitish yellow; outer side of tarsus of foreleg and midleg with black scales. Abdomen dark gray dorsally, pale yellowish ventrally.

Male genitalia (Fig. 9). Tegumen broad, lateral sclerite large, sub-elliptic. Uncus narrow distally, rounded apically. Socius thick and long. Gnathos with long termination, lateral processes long, sharp apically. Transtilla band-like, somewhat broadened laterally. Valva broad, more or less broadened distally, costa developed. Sacculus narrow, provided with a sharp ventral process at middle. Juxta broad, forked apically. Aedeagus stout, serrate dorsally, provided with a large upward dorsal carina at middle; caulis strong, coecum penis short; vesica with a group of 10–11 sclerotized sockets pointing to deciduous cornuti.

Female genitalia (Fig. 10). Papilla analis broad. Apophysis posterior with broad basal plate. Sterigma with broad lateral portion. Antrum long, sclerotized weakly, with slender internal sclerite. Signum a broad plate, provided with serrate margin.

Diagnosis. The new species resembles *G. hoshinoi* (Kawabe, 1964), but differs from the latter in: (1) Gnathos with longer lateral processes; (2) Sacculus provided with a sharp process at middle; (3) Aedeagus serrate dorsally, possessing a large upward dorsal carina at middle.

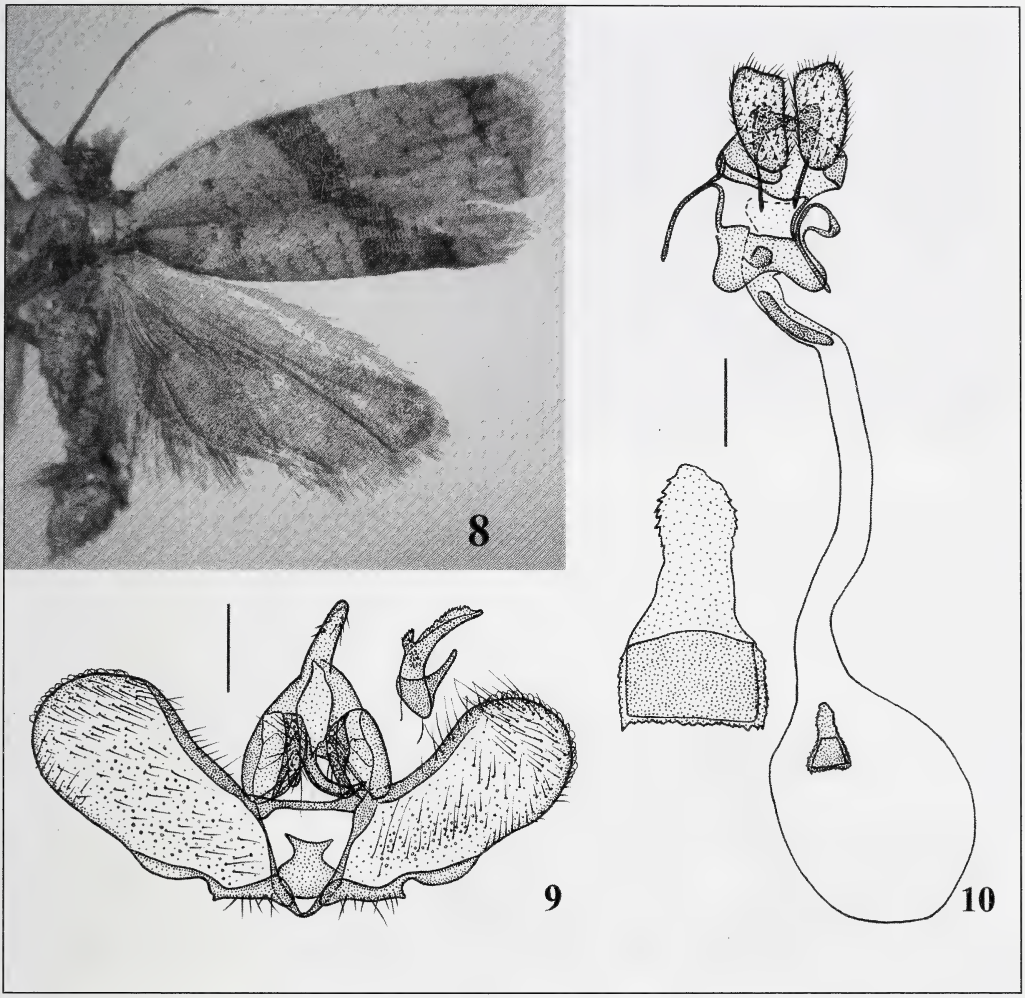
Derivatio nominis. The specific name is derived from the Latin word *serratus* (English: serrate), in reference to a dorsally serrate aedeagus.

Gnorismoneura quadrativalvata sp. n. **(Figs. 11–13)**

Material. Holotype ♂, **China**: Shaanxi Province, Fengxian County [33°55'N, 106°31'E], 1600 m, 7.vii.1988, Hou-Hun Li leg., genitalia slide No. WXP02246. – Paratypes: 3♀, same data as holotype; 2♂, 2♀, Zhouzhi County [34°10'N, 108°12'E], 1350 m, 14–19.vii.1987, Hou-Hun Li leg.; 2♂, Hebei Province, Zunhua City [40°11'N, 117°58'E], 9.vii.2001, leg. Yan-Li Du and Shu-Lian Hao.

Adult (Fig. 11). Wingspan 13.5–14.5 mm in male, 16.5–18.0 mm in female. Labial palpus thin and short, pale yellowish, 1.5 times shorter than diameter of compound eye. Antenna thin. Thorax brown. Apex short. Termen oblique and straight. Forewing broad, ground color yellowish brown; patterns dark brown: basal blotch small; median fascia broad posteriorly; subapical blotch large; cilia pale gray. Hindwing dark gray, cilia pale gray. Legs whitish yellow, outer side of tarsus of foreleg with black scales. Abdomen yellowish dorsally, pale yellowish ventrally.

Male genitalia (Fig. 12). Tegumen broad, lateral sclerite large, boot-shaped. Uncus short, broadening toward distal, with a small point at apex. Socius slender. Gnathos with broad plate terminally, lateral processes very long, sharp apically.



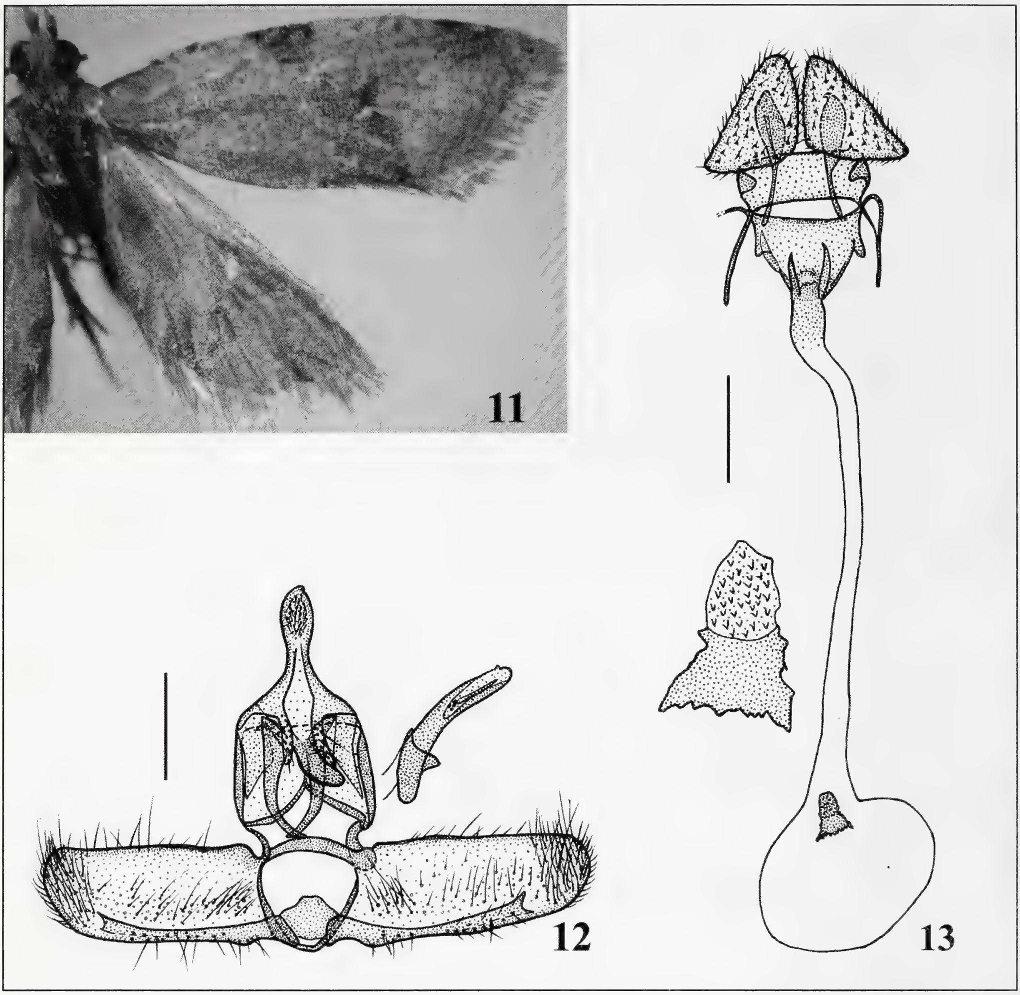
Figs. 8–10. *Gnorismoneura serrata* sp. n. **8.** Adult. **9.** Male genitalia. **10.** Female genitalia (reference bar 0.5 mm).

Transtilla band-formed, somewhat convex medially. Valva long, quadrate. Sacculus narrow, provided with a sharp termination. Juxta broad. Aedeagus stout, provided with a small dorsal carina apically; caulis and coecum penis short; vesica with four cornuti.

Female genitalia (Fig. 13). Papilla analis broad, triangular. Apophysis posterior with broad basal plate. Lateral portion of sterigma very small. Antrum broad, weakly sclerotized. Signum a broad plate, provided with serrate margin and lateral processes.

Diagnosis. The new species is allied to *G. mesotoma* (Yasuda), but it can be distinguished from the latter by the following characters: (1) Gnathos with much longer lateral processes; (2) Sacculus provided with a sharp carina at end; (3) Aedeagus with a very small carina; (4) Papilla analis triangular in the new species.

Derivatio nominis. The specific name is from the Latin words *quadratus* – quadrate, and *valvatus* – valva, referring to the shape of valva.



Figs. 11–13. *Gnorismoneura quadrativalvata* sp. n. **11.** Adult. **12.** Male genitalia. **13.** Female genitalia (reference bar 0.5 mm).

Gnorismoneura taeniodesma (Meyrick, 1934) (Fig. 14)

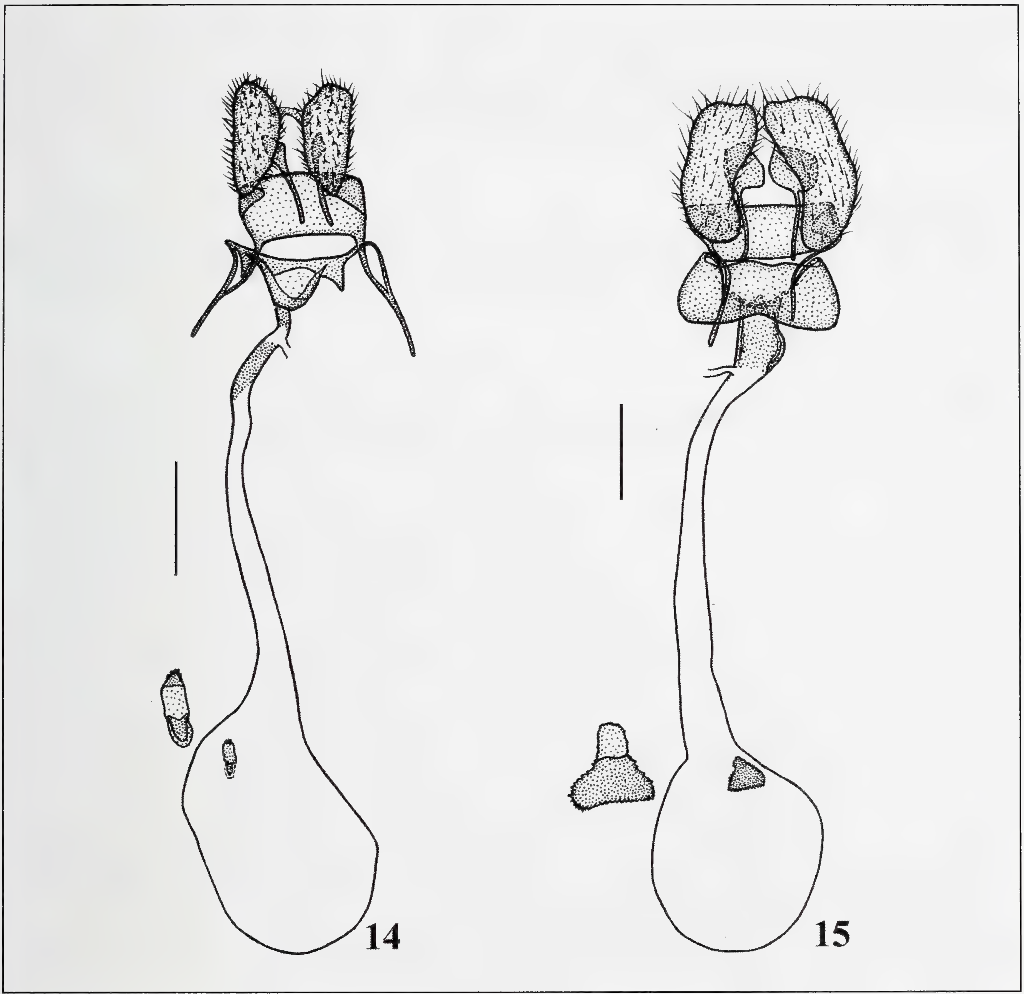
Capua taeniodesma Meyrick, 1934, Exot. Microlepid., **4**: 525. *Gnorismoneura taeniodesma* (Meyrick, 1934): Razowski 1977, Polsk. Pismo Ent. **47**: 590, figs. 15, 16.

Material. 2♂, 4♀, **China**: Guizhou Province, Chishui County [28°34'N, 105°42'E], 390 m, 27.–29.v.2000, Yan-Li Du leg.; ♂, 6♀, Guizhou Province, Xishui County [28°19'N, 106°12'E], 500 m, 31.v.2000, Yan-Li Du leg.; 5♂, 3♀, Guizhou Province, Chishui County [28°34'N, 105°42'E], 240 m, 21.–22.ix.2000, Hai-Li Yu leg.; 21♂, 9♀, Guizhou Province, Xishui County [28°19'N, 106°12E'], 500 m, 24.–29.ix.2000, Hai-Li Yu leg.

Female. Wingspan 16.5–18.0 mm, other characters same as in male.

Female genitalia (Fig. 14). Papilla analis broad. Apophysis posterior short, with broad basal plate. Lateral portion of sterigma small. Antrum narrow, sclerotized weakly. Base of ductus bursae sclerotized weakly. Signum small.

Notes. Razowski did not describe the female genitalia in 1977 because of lacking



Figs. 14–15. Female genitalia of *Gnorismoneura* spp. **14**. *G. taeniodesma* (Meyrick). **15**. *G. zetessima* Razowski (reference bar 0.5 mm).

female abdomen. It is described for the first time in this paper. The female genitalia of *G. taeniodesma* resembles the female genitalia of *G. mesoloba* (Meyrick, 1937), but without distinct sclerite in antrum.

Gnorismoneura zetessima Razowski, 1977 (Fig. 15)

Gnorismoneura zetessima Razowski, 1977, Polsk. Pismo Ent. **47**: 591, figs. 17, 18.

Material. **China**: 2♂, 4♀, Ningxia (Jingyuan County [35.29N, 106.19E], 2400 m), 7–8.viii.2000, Hou-Hun Li and Shu-Xia Wang leg.; ♂, Shaanxi Province (Fengxian County [33.55N, 106.31E]), 11.vii.1988, Hou-Hun Li leg.

Female. Wingspan 18.5–21.0 mm, other characters same as in male.

Female genitalia (fig. 15). Papilla analis very broad. Apophysis posterior short, with very broad basal plate. Lateral portion of sterigma broad. Antrum broad, with internal sclerite. Signum a broad plate, provided with serrate margin.

Notes. We have found the female and describe it here for the first time. The female genitalia of *G. zetessima* is similar to that of *G. stereomorpha* (Meyrick, 1931), but can be differentiated from it by broader antrum and longer inner sclerite.

Acknowledgements

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Short Communication

Apotomis fraterculana Krogerus, 1946, a northern tortricid moth in central Europe (Tortricidae)

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Apotomis fraterculana Krogerus, 1946 is a rare cold adapted species distributed in subarctic, northern boreal, and subalpine regions of Fennoscandia and Russia. The populations are mostly associated with open birch forests (Krogerus 1946, 1972; Opheim 1970; Kuznetzov 1978; Linnaluoto & Koponen 1980; Kozlov et al. 2000). The record from Romania (Razowski 1996) is an error corrected by Razowski (2003) himself. The larvae probably feed on *Betula* species (Krogerus 1946).

On May, 28, 2003 *A. fraterculana* was discovered in the Šumava Mts. (Böhmerwald), Czech Republic, central Europe. Two males were collected at light by Jaroš & Spitzer in the valley peat bog called Velká Niva, near Lenora (750 m alt., 48°50' N, 13°50' E). Velká Niva covers 120 ha and is situated in the peatland "archipelago" of the Vltavský Luh Reserve. The most famous locality within Vltavský Luh is Mrtvý Luh near Volary (see e.g. Spitzer et al. 2003, with bibliography). Velká Niva seems to be a similar bog type like Mrtvý Luh, but the lagg is forested by the waterlogged spruce forest. The central parts are covered by open forest of *Pinus rotundata* (=*P. mugo* s. lat.) with *Betula pubescens*. The flora and lepidopteran fauna associated with Velká Niva seem to be similar to those of Mrtvý Luh (Spitzer & Jaroš 2001 and unpublished records). The biogeography of the peat bog Lepidoptera (the tyrphobiontic taxa) in central Europe and their relationships to those of northern Europe are summarised by Mikkola & Spitzer (1983). Our record of *A. fraterculana* conforms to the idea of a pattern of relictual refuges of cold adapted species associated with isolated montane peat bogs in central Europe. It is interesting that the Fennoscandian populations of *A. fraterculana* are known from northern open birch forests ("forest-tundra") in subarctic and boreal lowlands and Scandinavian mountains only (e.g. southern Norway – Aarvik et al. 2000; Aarvik pers. comm.), but are not safely recorded from northern peatlands.

Diagnoses of *A. fraterculana* are given by Krogerus (1946), Opheim (1970), Kuznetzov (1978), and Razowski (2003). Our specimens of *A. fraterculana* from the Šumava Mts. conform to the taxonomical characteristics of Scandinavian specimens given by these authors. *A. fraterculana* is similar to *A. sororculana* (Zetterstedt, 1839) and *A. sauciana* (Frölich, 1828), and the most important distinguishing characteristics of *A. fraterculana* are as follows: (1) male genitalia: the spiny lobe of the sacculus has more than 60 spines and the cornutus of the aedeagus is long and curved; (2) in the forewings the outer edge of the dark median fascia is weakly angled inwards

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to middle (also in *A. sauciana*) while the outer edge of the dark median fascia is slightly indented and angled outwards, or nearly straight in *A. sororculana*, in the hindwings the underside in *A. fraterculana* is lighter compared with that of *A. sauciana*. The three species occur together in the Velká Niva bog, but *A. sororculana* and *A. sauciana* are also widely distributed in central and northern Europe. Another similarly cold adapted species of the genus *Apotomis*, *A. demissana* (Kennel, 1900), is recorded from northern Europe only.

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Short communication

Gentiana cruciata as an additional host plant of *Maculinea alcon* on a site in eastern Poland (Lycaenidae)

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The Alcon Blue *Maculinea alcon* ([Denis & Schiffermüller], 1775) inhabits wet grasslands or wet heaths throughout its European range (Wynhoff 1998). Females lay their eggs on the upper parts of *Gentiana pneumonanthe* (Gentianaceae), especially buds and flowers. *G. asclepiadea* and *G. germanica* have also been reported as alternative or additional food resources (Munguira & Martin 1999). Initially endophytic caterpillars feed on developing seeds but after their third moult they leave the flower heads to be adopted by *Myrmica* workers. In the ant nests, *M. alcon* caterpillars mimic ant larvae and are fed with regurgitation, insect prey and occasionally prey on ant brood (Thomas 1995). Host-ant relationships of *M. alcon* show geographical variation across Europe. Four *Myrmica* species have been identified as rearing this butterfly so far, although rarely more than one species is successfully exploited as host per site (Elmes et al. 1994; Als et al. 2002; Sielezniew & Stankiewicz 2002 and unpublished data). Habitat, host-plants and host-ants are regarded as the most important traits enabling distinction between *M. alcon* and its close relative *M. rebeli* (Hirschke 1904) (Settele et al. 2000).

At the end of August 2003 we investigated a *M. alcon* site at 'Brzeźno' reserve near Chełm (51°09'N 23°36'E, 170 m a.s.l.) in east Poland. The protected habitat, with calcium-rich soils, covers an area of 165 ha and consists of a unique mosaic of fen communities (dominant), moist grasslands and xerothermic grasslands. Two gentian species occur at 'Brzeźno': *G. pneumonanthe* which most commonly occurs in the *Molinietum medioeuropaeum* association but occasionally grows in adjoining habitats, and *G. cruciata* which is confined to drier patches of *Inuletum ensifoliae* vegetation (Kucharczyk 1996).

On one 0.25 ha xerothermic meadow we recorded eggs of *M. alcon* on both *G. pneumonanthe* and *G. cruciata*. In case of the less numerous *G. pneumonanthe* (about 20 individuals), eggs were present on every shoot but generally in lower numbers than on moist grasslands (11.6 ± 3.7, N=18 and 37.4 ± 20.3, N=17, respectively). On the more abundant *G. cruciata* (nearly 100 individuals) we recorded eggs on 23 of the plants. Presence or absence of eggs depended mainly on the physiological condition of plants. Those that looked fresher (with flowers and green leaves) carried up to 15 eggs per shoot (5.1 ± 3.7) while completely withered plants never had eggs. We dissected occupied *G. cruciata* plants but in most of them we found neither *M. alcon* larvae nor any damage and/or faeces. Eggs had apparently

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hatched, but it seemed that caterpillars failed to establish on the plants. Just in 10 flowerheads we found traces of feeding and two *M. alcon* larvae of the third instar inside the single bud. We searched the ground for *Myrmica* nests within two meters of every plant bearing eggs. The dense soil of this place seemed generally not to be favourable for ants, and we detected only four nests in the total area of about 100 m^2: three of *My. scabrinodis* Nylander, 1846 and one of *My. sabuleti* Meinert, 1861 (Czechowski et al. 2002). One *M. alcon* larva, slightly bigger than a freshly adopted one, was present in a colony of *My. scabrinodis*, which is known as the true host-ant of *M. alcon* in this region (Sielezniew & Stankiewicz 2002). Since the nearest *G. pneumonanthe* plant was 10 m away, the caterpillar undoubtedly had passed successfully endophytic development on *G. cruciata,* which indicates that *G. cruciata* may serve as an additional host-plant of *M. alcon* on the site.

Until now *G. cruciata* has been attributed exclusively to *M. rebeli*, which is recorded in Poland in only a few sites, in the south. Use of *G. cruciata* by *M. alcon* has been probably more widespread in the past. We found eggshells in a herbarium on plants collected in the 19th century on a few sites in the region of present studies (Lubelska Upland). Considering the existence of *M. rebeli* populations using *G. germanica* in Switzerland (Jutzeler 1988) and *G. asclepiadea* in Bulgaria (Kolev 2002) our finding provides another argument against the assumption of clear-cut differences between these two butterfly species. Moreover *My. scabrinodis* is also an important host-ant of *M. rebeli* in Poland.

However the flight period seems to be the most distinctive feature differentiating Polish populations of *M. alcon* and *M. rebeli*: mid July to end of August and mid June to mid July, respectively (Sielezniew et al. 2003). At Brzeźno first butterflies are on the wings when the last *G. cruciata* plants are suitable for oviposition in some seasons. In previous years we did not observe eggs on *G. cruciata* which can be explained by different weather conditions (early spring and subsequent drought in 2003). For a change some *G. pneumonanthe* plants each year were still suitable for *M. alcon* even long time after the end of flight period. The earlier appearance of *M. rebeli* in Poland coincides with the flowering phenology of *G. cruciata.* Observed differences in prehibernation growth rate between caterpillars of both species in ant nests (Sielezniew et al. 2003) might serve as an adaptation to using different plants rather than the exploitation of different ant species.

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Book review

N. P. Kristensen (ed.) 1999. Lepidoptera, Moths and Butterflies. Vol. 1: Evolution, Systematics, and Biogeography. x + 491 pp. – *In*: M. Fischer, Handbook of Zoology **4**. Arthropoda: Insecta, part 35. – Walter de Gruyter, Berlin & New York. Price: 214,00 €. ISBN 3-11-015704-7.

N. P. Kristensen (ed.) 2003. Lepidoptera, Moths and Butterflies. Vol. 2: Morphology, Physiology, and Development. xii + 564 pp. – *In*: M. Fischer, Handbook of Zoology **4**. Arthropoda: Insecta, part 36. – Walter de Gruyter, Berlin & New York. Price: 248,00 €. ISBN 3-11-016210-5.

Since Linnaeus (1758) described the first taxa of Lepidoptera, countless scientific results have been published about this insect order, which is one of the most speciose animal groups on earth. While a large amount of knowledge about Lepidoptera has been published before the middle of the 20th century, research in Biological Systematics became revolutionised particularly by the theory and method of Phylogenetic Systematics by Willi Hennig (1950). Subsequently, the knowledge about systematics and evolution of the Lepidoptera increased significantly. However, at the same time specialisation in science increased considerably and it became more and more important to summarise the scattered knowledge. In this regard, Malcolm Scoble's book "The Lepidoptera – Form, Function and Diversity", published in 1992, was a milestone and served as *the* standard reference for Lepidoptera for more than a decade. However, Malcolm had only about 400 pages to treat the many subjects and the many taxa of Lepidoptera, and thus, a more comprehensive compendium remained still in need. For such a purpose, the *Handbook of Zoology* series is an ideal platform to combine so many subjects like systematics, evolution, biogeography, morphology, physiology and development of these insects, still leaving molecular biology, genetics and cell physiology aside. The *Handbook* of Lepidoptera became a long-lasting project, which already started in the mid-1980ies, when Niels Peder Kristensen took over the editorship for the two volumes on Lepidoptera. During this time, numerous outstanding Lepidopterist's contributed to the *Handbook*, not all of them continued up to the end, resigned or deceased before it became published. Finally, 56 authors are still listed who completed the two volumes opus.

In 1999, the **first volume** appeared, mainly dealing with systematics and evolution of the Lepidoptera. It comprises 21 chapters, each written by one or several specialised authors, giving a historical introduction of principal pre-1900 contributions to the foundation of contemporary Lepidopterology, an overview of the lepidopteran groundplan, the phylogeny above superfamily-level, palaeontology, a classification and keys to higher taxa, followed by treatments of the non-glossatan groups, the homoneurous Glossata, the monotrysian Heteroneura, the Tineoidea and Gracillarioidea, the Yponomeutoidea, the Gelechioidea, the Zygaenoidea, the cossoid/ sesioid assemblage, the Tortricoidea, the smaller microlepidopteran-grade superfamilies, the Pyraloidea, the Axioidea and Calliduloidea, the butterflies, the drepanoid/ geometroid assemblage, the Bombycoidea and their relatives, the Noctuoidea, and it is concluded by two chapters about the evolution of larval food preferences and biogeography of the Lepidoptera. Within the volume, the phylogenetic relationships of the taxon Lepidoptera, its basal lineages and its 46 recognised superfamilies constitute a focal issue. This is mostly not aimed at presenting a neatly resolved classification (which would inadequately simplify the subject) but includes to some extent the discussion of different phylogenetic hypotheses and the character conflicts behind. Each of the 16 chapters treating the large groups of Lepidoptera, from the non-glossatan groups to the Noctuoidea, gives an overview of the group treated and its taxa down to family-group level, comprising the relevant autapomorphies (so far known) and detailed descriptions of immatures and adults, as well as general information on life history, species numbers and biogeography. Each chapter includes at least one plate illustrating the range of general appearance of the adults in that group. The text is supported by numerous figures of the head, the wing venation, the legs, male and female terminalia, the larvae, pupae and other features. All chapters close with a comprehensive list of references, and the entire volume with an index of scientific Lepidoptera names, comprising 24 pages.

The **second volume** has been published in early 2003 and completes the *Handbook* on Lepidoptera. It treats the morphology, physiology and development of the Lepidoptera, in a total of 19 chapters about the lepidopteran integument, 'hairs' and scales, coloration patterns and their morphogenesis, skeleton and muscles of adults and immatures, digestive and excretory systems, respiratory system, circulation and thermoregulation, nervous system, sensilla and proprioceptors, auditory and sound producing organs, eyes and vision, exocrine glands for chemical communication and defense, labial glands producing silk and saliva, endocrine glands and hormones, reproductive organs, karyology and sex determination, eggs, and embryology. The text of each chapter is supported by numerous figures and completed by a comprehensive list of references. Near the end of the volume, a cladogramm for the superfamilies and higher taxa is given again, together with a list of the adopted Lepidoptera system. The volume closes with an index of the generic names mentioned in volume two, with assignment to the family-groups, and relevant chapter numbers in the systematics section of volume one.

Like volume one, the second volume is full of information on the various aspects treated. Characters are discussed also in context above ordinal level to ensure that homologous or at least morphologically identical entities are treated. This is of special importance, because entomologists developed terminologies often independently for different insect orders, especially with regard to taxonomic literature. As a result, the same term is sometimes used for non-homologous structures. For Lepidoptera, examples are the structure in male genitalia called 'aedeagus', which in the morphological sense indeed is a phallus in most Lepidoptera (Kristensen, p. 103–105) and in female genitalia the 'ovipositor', which is a well-defined structure of the insect ground-plan and absent in Lepidoptera (Kristensen, p. 113). With the comprehensive and detailed chapters 'skeleton and muscles: adults' and 'reproductive organs' written by Niels Peder Kristensen, the so far standard source for lepidopteran genitalia by Klots (1970), which is outdated since a long time, is finally much more than well replaced.

The space available here is by far too much limited to give examples of the many well written chapters. The two-volumes opus on Lepidoptera fulfils the highest standards of a handbook. It is comprehensive, though its editor, Niels Peder Kristensen, stated in his privileged diplomatic personality "The accumulated knowledge about larger animal groups such as the Lepidoptera has now reached such a magnitude that no manageable 'Handbook' account can be comprehensive in the strict sense of the word." This in the perfect sense will certainly never be achieved.

The books are published in A4-size and the text is written in very concise style, so the volumes are filled with densely packed information. Each chapter closes with a comprehensive list of references, enabling a perfect embarking on the subject treated. The *Handbook* on Lepidoptera gives extensive insights into the various aspects of Lepidoptera dealing with systematics, evolution, biogeography, morphology, physiology and development. Most Lepidopterist's will even learn about new facts on the group(-s) they are specialised in. The *Handbook* will undoubtedly serve as a standard source for students and scientists working on Lepidoptera, independently of the subject they are specialised in, e.g., ecology, genetics, morphology, systematics or others. Of course, the books are expensive, but they are worth their money. All authors did a very good job and many of them were prompted to undertake substantial research for the preparation of their contributions and thus the books became really innovative. Niels Peder Kristensen should be expressively acknowledged here. He acted not just as an editor of the *Handbook*, which alone occupied him for many years. Altogether, Niels wrote five chapters on his own, and co-authored 11 further ones. During decades, he published outstanding results about systematics and morphology of Lepidoptera, e.g., about the early evolution of Lepidoptera (e.g., Kristensen 1967, 1984, 1997; Kristensen & Nielsen 1979), which well qualified him for this project. Congratulations to Niels and all other authors to this two volumes opus. I hope it will obtain the attention it deserves, and will be extensively used by the lepidopterists community.

MATTHIAS NUSS

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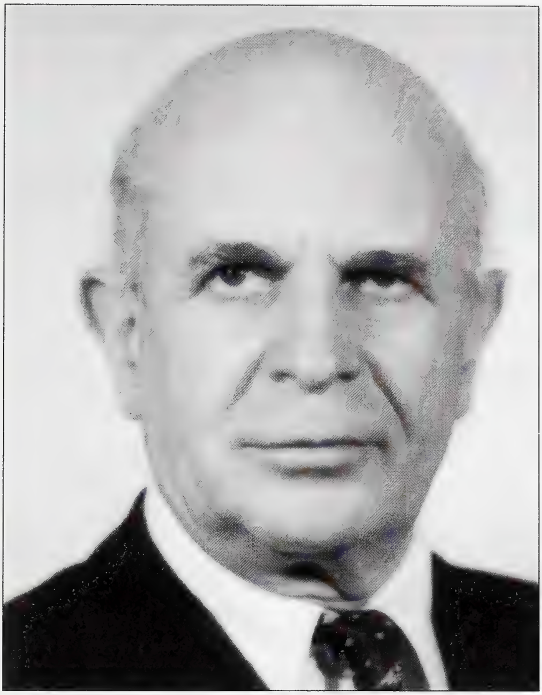

Professor Dalibor Povolný
13 November 1924 – 6th of November 2004

Professor Dr. Ing. Dalibor Povolný, Dr. Sc., Dr. h.c., our good friend and colleague, acknowledged lepidopterist and dipterist world-wide, lost his struggle against a grave disease on the 6th of November 2004, only a week before his 80th birthday.

Dalibor Povolný was born on 13 November 1924 in Třebíč, a small town in western Moravia, in the family of a teacher. Ever since his boyhood he was taught to love Nature. He was strongly influenced in that direction by his father and by Antonín Růžička, entomologist and Dalibor's schoolmaster. Immediately after the end of World War II, Dalibor Povolný enrolled at the Faculty of Agronomy of the University of Agriculture in Brno. Already during his university studies he worked as an assistant at the Institute of Applied Entomology under the leadership of Professor Miller. At the same time, his other love – singing – brought him to the study of operatic singing at the Brno conservatory, and he had close contacts with the cultural activities in Brno. Dalibor Povolný started to work at the Entomological Laboratory of the Czechoslovak Academy of Sciences after having finished his military service in 1953. Shortly

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thereafter he entered the newly established Parasitological Institute in which, together with Dr. Rozsypal and Dr. Gregor, he founded a working team that concentrated on the study of synanthropic flies, gadflies, and pupiparous Diptera. In 1961, Dalibor Povolný qualified as a university lecturer in zoology at the University of Agriculture in Brno, and in 1968 he was appointed professor of zoology at that University. In 1962 he became the head of the Institute of Zoology of the Faculty of Agronomy. In 1965–1969 he also lectured in parasitology at the Nangrahar University in Afghanistan, at the same time developing intense research on insects and mammals. In 1971, for political reasons, he was stripped of all his academic functions, was forbidden to lecture and publish, and was moved to a detached workplace at Lednice in southern Moravia. There he devoted all his time to continued extensive investigations. Unfortunately, it was not until 1989 that he could present his results in their full extent to the scientific public. In 1990 and 1991 he was vice-chancellor of the University of Agriculture in Brno. In 1991 he was pensioned, but this brought no change to his life habits. He continued to work in the Institute of Zoology and Apiculture at the Mendel University of Agriculture and Silviculture, and his working activity seemed to grow, as if he tried to catch up with all that he had missed.

The scope of Professor Povolný's scientific knowledge was considerable, but the study of Lepidoptera and Diptera was always the centre of his interests. He and František Gregor, his lifelong friend, were among the first in the Czech Republic to engage in serious scientific studies on Microlepidoptera. Their joint efforts yielded a number of papers on mining species, especially of the genus *Phyllonorycter,* and a comprehensive paper on Moravian burnet moths. In the early 1950s, Povolný started to specialise himself in the study of moths of the family Gelechiidae, and very soon he became a foremost specialist of this insect group. For example, he worked on a voluminous material of South American gelechiids and studied the Californian species of this group. The scientific results obtained by Professor Povolný are admirable. Let us just mention the mere fact that he described over 250 taxons as new to science.

At the turn of the 1950s, Dalibor Povolný was charged with the task of studying synanthropic and parasitic Diptera. Although being rather compelled to do it, Povolný took to the job with his characteristic enthusiasm and he soon assumed the leadership of a productive team. Among other involvements, the team was invited to co-operate in the monumental work on "Flies and Disease", edited by Professor Greenberg and published in the USA in 1971. In 1997, Povolný's many years' study of the central European flesh flies yielded an extensive monograph published in Munich, Germany, that is widely used throughout Europe. Povolný worked on flesh flies intensively, particularly during the past decade. Every year he travelled to various parts of central Europe and the Mediterranean region to study them. His last trip in June 2004 was to his beloved Sicily. Already suffering from considerable health problems and pains, he still worked hard in the field. He was fully aware of his impaired health, yet he never ceased persuading himself that it might yet improve so that he would be able to complete his unfinished projects.

Povolný's interest did not concentrate only on flies, butterflies, and moths. He also devoted much of his time to a number of theoretical as well as practical problems in ecology, domestication, evolution, and forensic entomology, to name a few. He was an enthusiastic popularizer of zoology and entomology in the broadcasting media and popular magazines, and he gave many lectures to the general public and to scientific audiences both at home and abroad. He was regularly invited to give lectures several times each year and he always tried to oblige. He participated in a large number of international congresses and symposiums, some of them organised by himself. He was a member of numerous national and international scientific societies. His publishing activity was incredible. He is the author of some 350 original scientific papers, a number of comprehensive monographs, and hundreds of other articles and communications. His work in this field was highly appreciated.

Professor Povolný was an ardent scientist and, like most scientists, he did dislike being disturbed when working. Nevertheless, he was always very obliging and ready to help in any way possible. To save time, he would run rather than walk along the University's corridors. His memory was excellent, and his ability to clearly and rapidly formulate his ideas in a discussion was amazing. However, he often stuck to his opinions without compromise, which got him involved in a number of problems. Sometimes it was difficult, or even impossible to convince him that he was mistaken.

Povolný was not one of those tedious scientists. His sense of humour was known to everybody. He never ruined the good mood of a party, he was an excellent storyteller, and he never spoilt a joke. That is why he was often the centre of attention, even at scientific meetings, and at times a discussion on a serious scientific topic would often take quite a different direction... Professor Povolný could perfectly mimic the voices of his friends and, above all, those of the colleagues with whom he disagreed in ideology or expert opinions. And in matters he considered important he could fight like a Kilkenny cat.

Dalibor loved art and, above all, music. He was an excellent operatic tenor, and he could not forget about it even during his scientific work. He would sing when examining specimens in his lab and during field work. His sonorous voice would resound at considerable distances so that one would first hear an aria and then only glimpse a man sweeping his entomological net. Loaded with an incredible amount of energy, Dalibor was an unforgettable personality that seemed to be indestructible…

Zdeněk Laštůvka

Multivariate analysis of male genital structures in the *Hipparchia semele-muelleri-delattini* complex (Nymphalidae, Satyrinae) from the Balkans: how many taxa?

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Abstract. Two closely related *Hipparchia* taxa, *Hipparchia delattini* Kudrna, 1975 and *H. semele muelleri* Kudrna, 1975 have been described from the Balkans based on differences in male genital structure, compared to each other and to another nominal European taxon (*H. semele* Linnaeus, 1758). Subsequently, Kudrna (1977) synonymised both *H. delattini* and *H. muelleri* with *H. volgensis* (Mazochin-Porshnjakov, 1952). Application of multivariate statistical techniques on male genital data indicates a cline in several aspects of genital morphology linking these three taxa across Europe. Although clusters are repeatedly found that correspond with the three taxa, it is not possible to ascribe every individual specimen to one of the three *Hipparchia* taxa. *Hipparchia muelleri* is shown to occupy an intermediate position between *H. semele* and *H. delattini*. Generally, *H. delattini* is present in an area covering part of northern Greece and the central Balkans. *H. semele* is present in western Europe, the Balkans and down the western side of Greece. However, individual specimens that classify to *H. delattini* in the current analyses may occur much further west, where historically only *H. semele* has been, and there appears to be a correlation between putative taxa and altitude with *H. delattini* occurring at higher altitudes. It is suggested that genetic differentiation between these taxa has been maintained and enhanced during glacial-interglacial cycles. The results of this study are discussed in relation to other morphological characters and biogeography and require further testing with molecular data.

Key words. Lepidoptera, Nymphalidae, Satyrinae, *Hipparchia semele*, *Hipparchia delattini*, *Hipparchia muelleri*, *Hipparchia volgensis*, genitalia, Balkans, biometrics, numerical taxonomy.

Introduction

Kudrna (1975), through comparison of male genital structures in a relatively small number of specimens, described two *Hipparchia* taxa from Greece and the Balkans, namely *Hipparchia muelleri* (type locality: Mt. Chelmos, southern Greece) and *H. delattini* (type locality: Pristina, Kosovo), differentiating them from each other and from *H. semele* (Linnaeus, 1758; type locality: Sweden). Later, Kudrna (1977) synonymised both *H. delattini* and *H. muelleri* with *H. volgensis* (Mazochin-Porshnjakov, 1952). According to Kudrna (1977), the *H. semele* male valve has a prominent terminal dorsal process, which is triangular in shape, and a well-pronounced distal termination, while in *H. delattini* the dorsal process is poorly pronounced. *H. muelleri* has a valve dorsal process that is intermediate between *H. semele* and *H. delattini* (Kudrna 1975; Coutsis 1983).

In a study to test the validity of these nominal taxa (Wakeham-Dawson et al. 2003), discriminant function analysis (DFA) was used to compare *Hipparchia* specimens

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captured in Greece and the Balkans against specimens of nominal taxa from type localities (topotypes). This analysis indicated the presence of specimens consistent with one or other of the topotypical concepts of *H. semele*, *H. muelleri* and *H. delattini* in the area. We did not incorporate topotypical *H. semele* material from Sweden, but our sample of this species included specimens from southern England, Spain, France and various localities to the north of the Balkans from Italy to Romania. However, in the same study, cluster analysis of a sample of these data without preconceptions of the validity of the taxa cast doubt on the presence of three taxa (Wakeham-Dawson et al. 2003). The cluster analysis indicated two main groups: a Balkan cluster (incorporating the majority of the nominal *H. muelleri* and *H. delattini* specimens of the DFA analysis) and an extra-Balkan cluster (incorporating mainly nominal *H. semele* specimens of the DFA analysis). There was some, albeit limited, overlap between the clusters that could be the result of errors in measurement, or represent hybrids, or a continuum between the two clusters, which might become more apparent with additional data.

The results were thus inconclusive. To test these hypotheses further, and supplied with additional data from the second author that extended through areas of the Balkans not represented in the first analysis, the current paper returns to the question: is it possible to recognise more than one discrete taxon in the Balkan area? Such issues in taxonomy require several distinct approaches: (i) the investigation of dimensionality and relationships in and among variables and the placement of individuals and putative taxa within axes describing these dimensions; (ii) the degree to which putative taxa can be discriminated within the space described by the variables; (iii) an exploration of natural clusters (putative taxa) using information on the specimens representing them. This latter approach makes no prior assumptions about the allegiance of individuals and works either by determining whether a fixed number of clusters exist or by allowing numbers of clusters (taxa) to be generated by the data.

Preliminary analysis by the second author of an initial data set including 91 specimens and using Lorkovic's total and partial transitions method (see Sijarić 1980) failed to show a clear separation between Balkan specimens subjectively classified as *H. delattini* and *H. semele*, when uncus length was plotted against valve length. It should be noted that the current study does not include specimens of the more distantly related Balkan species *Hipparchia senthes* (Fruhstorfer, 1908) (see Olivier & Coutsis 1997; Wakeham-Dawson et al. 2003).

Methods

Sources of data and measurements. The genitalia data used in the current study are taken from 82 male butterfly specimens captured in the Balkans and other areas in Europe (see Appendix). These include measurements from 20 specimens in the second author's collection added to the data set used for B_k analysis in Wakeham-Dawson et al. (2003), as well as further specimens from the northern Balkans included in that analysis but not clustered. Of these, 54 specimens have been identified by subjective comparison of genitalia (see Kudrna 1977; Jakšić 1998) and capture locality in relation to type locality for the nominal taxa; a further 28 specimens are not assigned to a taxon. The first author made all the measurements using the methods described in Wakeham-Dawson (1998) (see Fig. 1). Diagonal length (DL) is divided by valve length (VL1) to produce a unitless ratio *D*, which measures overall proportion (shape) of the genitalia independently of size variation between individuals in a taxon. Similarly, valve length (VL1) is divided by valve breadth (VB2) to produce a ratio *V1*, representing overall valve shape. Posterior valve length (VL2) is divided by posterior valve breadth (VB1) to produce a ratio *V2*, representing valve shape at the posterior end of the valve. Uncus length (UL) is divided by uncus breadth (UB) to produce a ratio *U*, representing uncus shape. Brachium length (BL) is divided by brachium breadth (BB) to produce a ratio *B*, representing brachium shape. Tegumen length (TL) is divided by tegumen breadth (TB) to give a ratio *T*, representing tegumen shape, and phallus length (PL) is divided by phallus breadth (PB) to give a ratio *P*. This provides 20 variables (13 measurements and 7 ratios) for analysis.

Statistical analysis. We first investigated the dimensionality and relationships among the genitalia variables using principal components analysis (PCA). This also allows the examination of specimens, and the taxa to which they putatively belong, in a reduced space accounting for key amounts of the variance, typically the first two dimensions. We entered key geographical variables (latitude, longitude and altitude) as supplementary to the analysis allowing trends in variables and taxa to be determined.
Second, we determined the degree to which the *Hipparchia* specimens can be discriminated and classified to taxa by using discriminant function analysis (DFA). DFA, like PCA, also produces linear combinations of the original variables, but DFA constructs these new variables (discriminant functions) to maximize differences between groups allocated a priori to analysis. To be completely effective as a technique the groups need to be allocated on different criteria (variables) from those used in the DFA. We have not been able to apply such rigour here. But, a number of the individuals (N = 54) were previously allocated to taxa on the basis of geography and visual inspection of the genitalia, as indicated above, independently of this analysis. DFA is particularly useful in the current case for identifying significant discriminatory variables and for classifying specimens without labels. For DFA, variables were first selected as being significant discriminators by applying ANOVA. We have chosen non-metric multidimensional scaling (NMMS) based on Mahalanobis's distance (D^2) for the placement of individuals in the multidimensional discriminant space; this allows distances on all discriminant axes to be adequately portrayed instead of their placement on just the first two discriminant axes. DFA produces Mahalanobis's D^2 between taxa and groups. The closer a particular specimen's discriminant score is to a particular taxon's mean location (centroid) in the discriminant space (measured by Mahalanobis's D^2) compared to the mean location of other taxa, the more likely it is that it belongs to that taxon. Similarly, the closer a taxon (represented by group centroids) is to another in discriminant space, the more similar the two are morphologically. Wilks's lambda (λ) measures the discriminatory power of the model. Its value ranges from 0 (perfect discriminatory power) to 1 (no discriminatory power). The

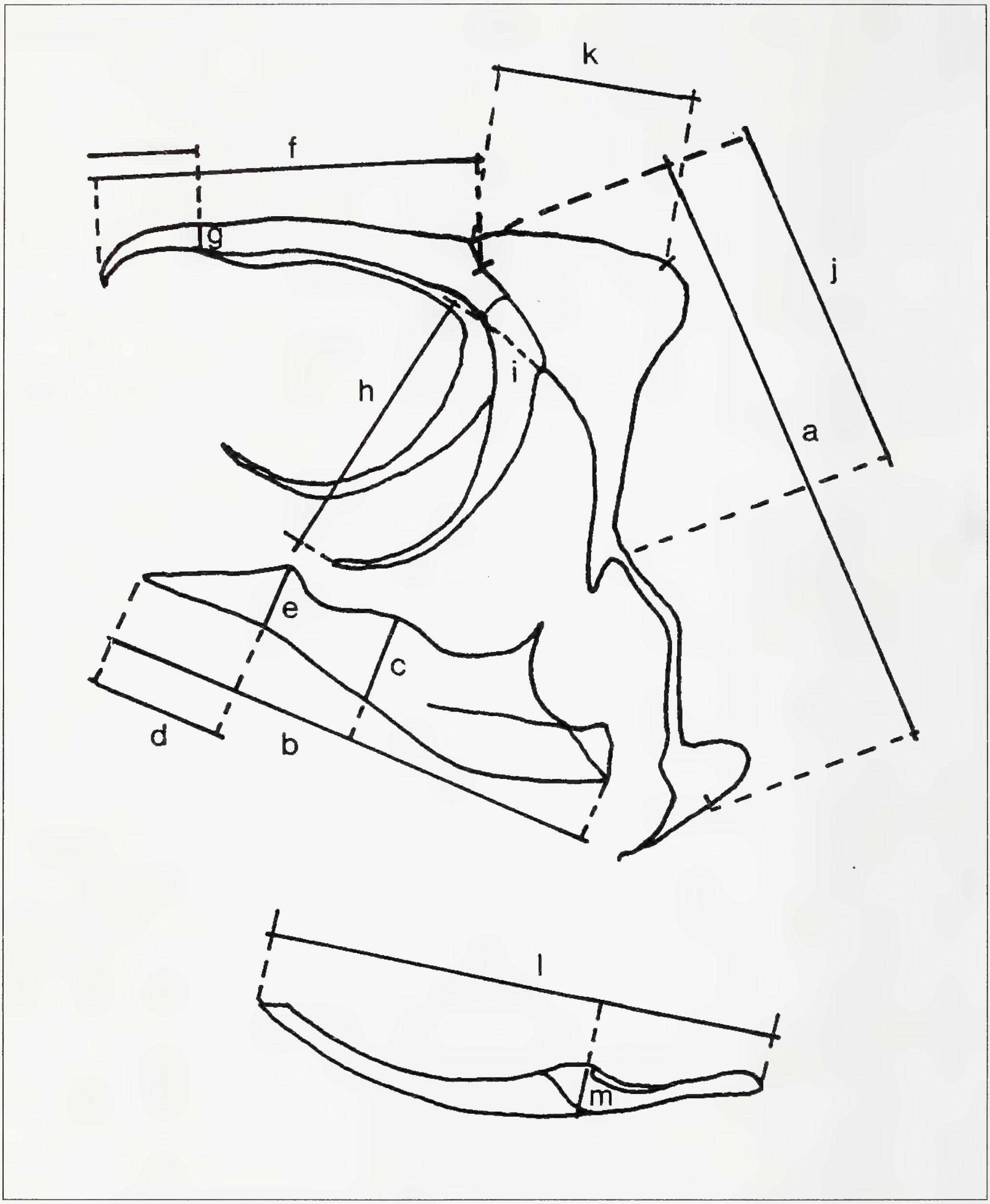

Fig. 1. Diagram of male genitalia, including measurements made on male genitalia, of *Hipparchia* butterflies. Terminology based on Higgins 1975. a = diagonal length (DL), measured from dorsal junction of tegumen and uncus to base of saccus (the line running at the same angle as the vinculum); b = valve length (VL1); c = valve breadth (VB2), measured across the widest part of the central valve process and at 90° to the line b; d = posterior valve length (VL2), measured from valve apex to line e; e = posterior valve breadth (VB1), measured across the widest part of the terminal valve process and at 90° to the line b; f = uncus length (UL), measured from uncus apex to mid-point between junction of tegumen and uncus; g = uncus breadth (UB), measured at 0.5 mm from uncus apex and at 90° to line f; h = brachium length (BL), measured from apex of brachium to dorsal junction of tegumen and brachium; i = brachium breadth (BB), measured across junction of tegumen and brachium; j = tegumen length (TL), measured from dorsal junction of tegumen and uncus to junction of apex angularis and vinculum, at same angle as line a; k = tegumen breadth (TB); l = phallus length (PL); m = phallus breadth (PB).

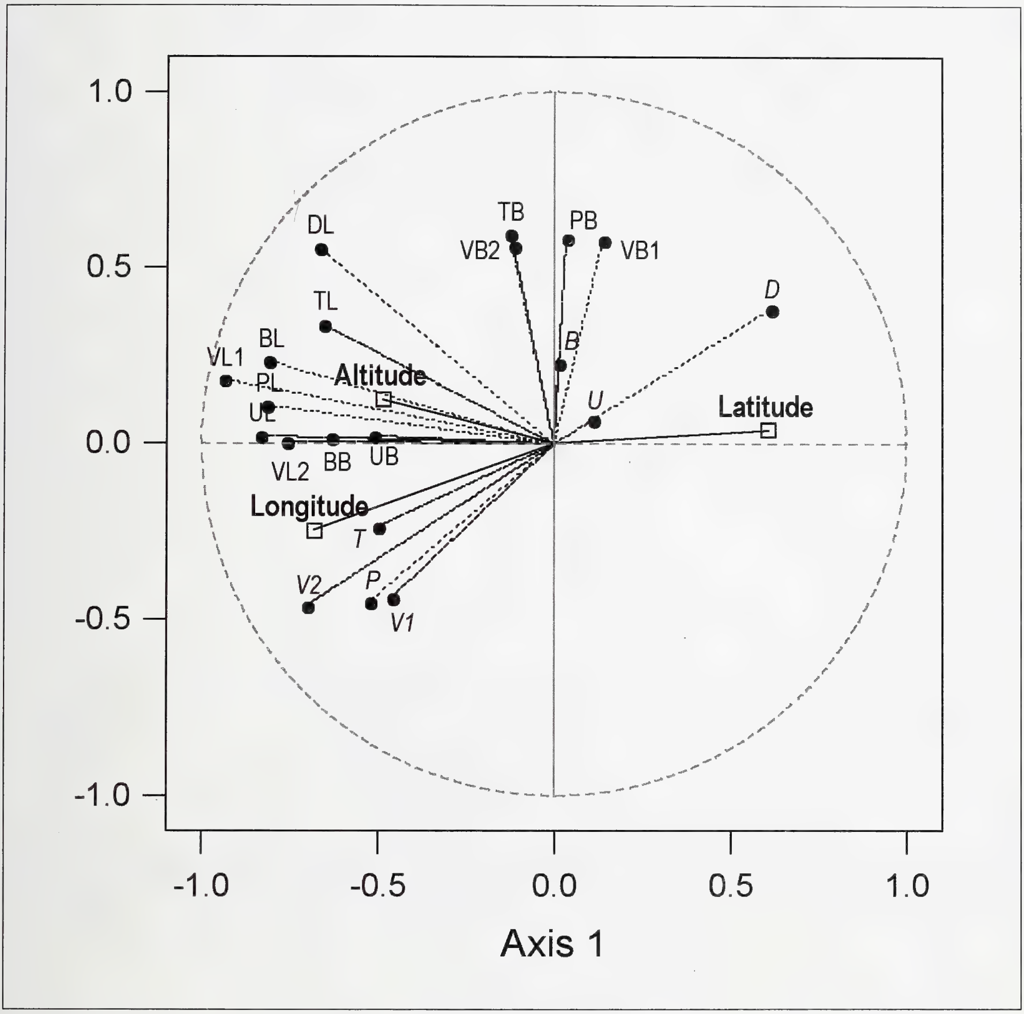

Fig. 2. Principal components analysis of 20 genitalia variables (13 measurements and 7 ratios) in *Hipparchia* (N = 82). Geographical variables (latitude, longitude and altitude) were entered as supplementary to the analysis. See Tables 2 and 3 for eigenvalues and loadings for axes.

success of DFA is determined by the percentage of specimens classified correctly as predicted, which itself requires prior assumptions of the validity of the taxa involved and of material that can be referred definitely to them.

Third, we subjected the data on the 82 specimens for the 20 variables to k-means clustering (Legendre & Legendre 1998). This technique starts with *k* random clusters and then moves objects between those clusters with the goal to (i) minimize variability within clusters and (ii) maximize variability between clusters. The technique is related to ANOVA, and the success of the operation is determined from the F statistics associated with each dimension (variable). It is a suitable technique for situations when a certain number of groups is suspected to exist and allows the testing of *a priori*

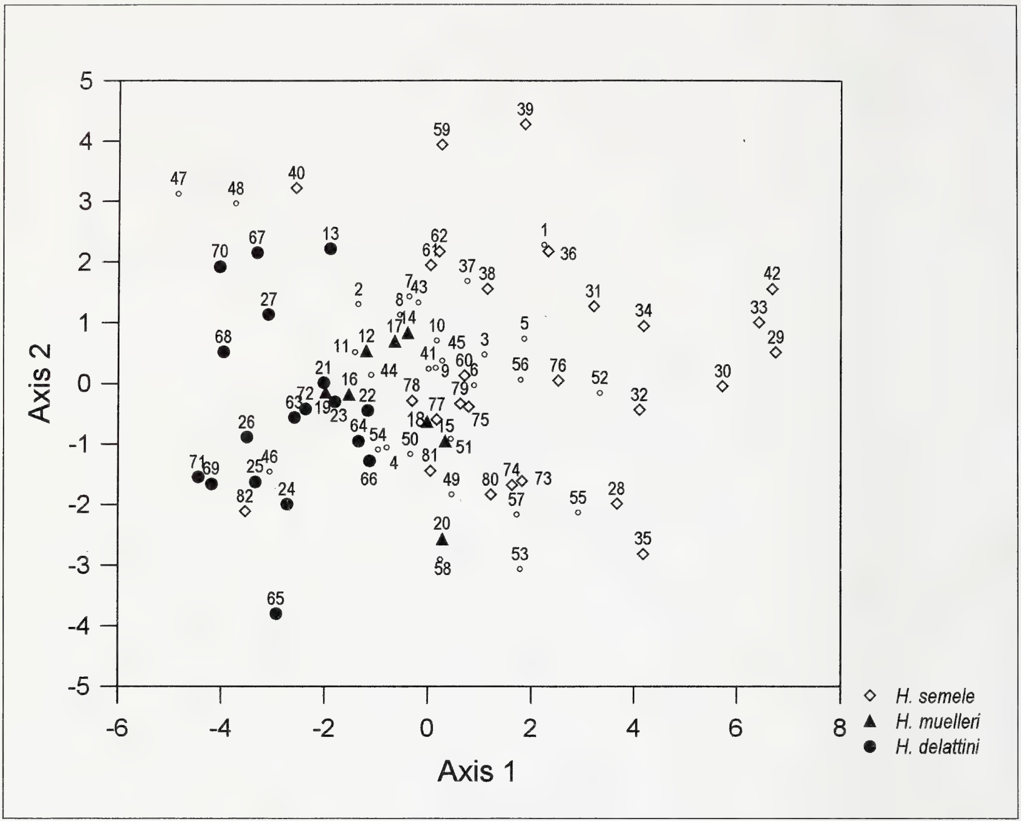

Fig. 3. Placement of *Hipparchia* specimens (N = 82) in the first two axes of a principal components analysis for 20 genitalia variables (see Fig. 2 and Tables 2 and 3). Undesignated specimens prior to analysis indicated by small dots.

classifications. Here, we tested for 3 groups as three putative taxa occur but also discuss results for a 2*k* solution. The approach we used is to 'seed' the analysis with three 'types' for *H. semele* (awd281 (case 30) from Eastbourne, Sussex, UK), *H. muelleri* (awd127 (case 12) from Mount Chelmos, S. Greece) and *H. delattini* (pj117 [kos-5/6293] (case 65) from Pristina, Serbia), the latter two coming from the type localities and chosen independently of the DFA.

Fourth, non-hierarchic (permitting clusters to overlap) B_k clustering procedure of Jardine & Sibson (1968) is used to explore clustering structure in data sets, using association coefficients (Euclidean distance measures) derived from all variables. This method is independent of *a priori* classifications or hypotheses of the number of groups expected. B_k clustering is used to build up linkage diagrams from low to progressively greater distance levels and assessing them for clustering structure. In B_k clustering, as values of k increase, the number of links required below a certain distance level for an operational taxonomic unit (OTU) to join a cluster is equal to k, but k-1 OTUs can also fall into an overlap between clusters under certain circumstances

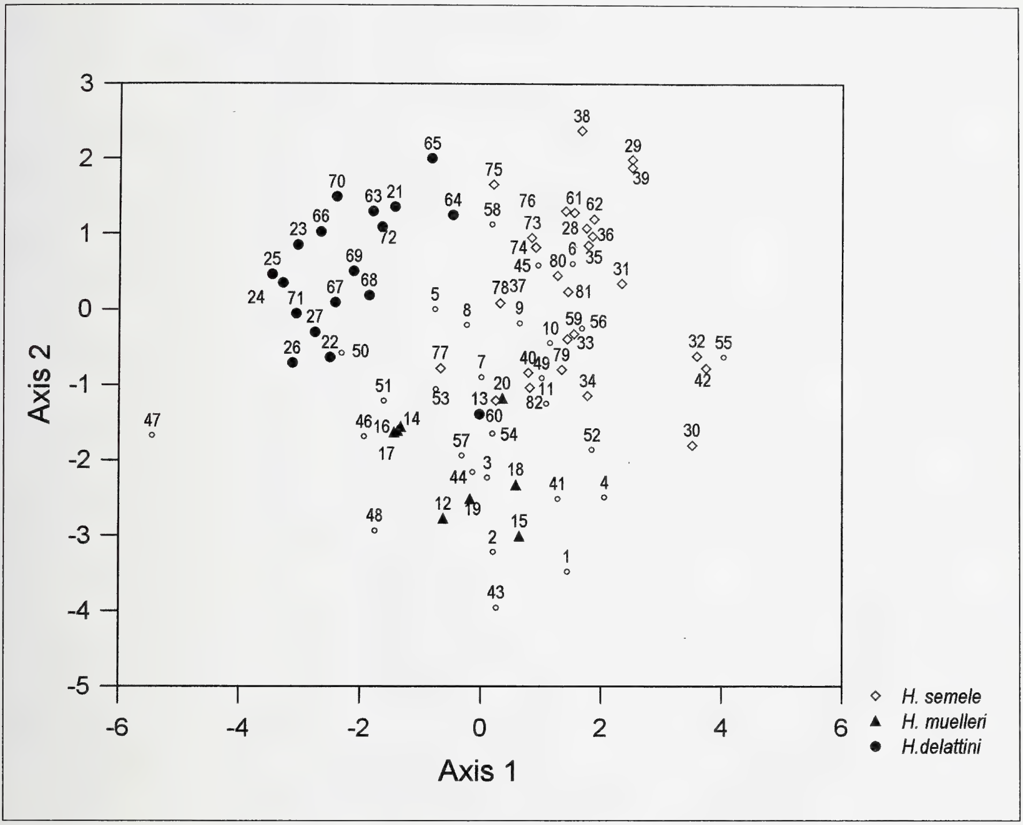

Fig. 4. Non metric multidimensional scaling plot (2 dimensions) of Mahalanobis's D^2 distances for the 82 *Hipparchia* specimens based on 20 variables (measurements and ratios). Kruskal stress and coefficient of alienation < 1%. See Appendix for specimen locality data and text for explanation. Undesignated specimens prior to analysis indicated by small dots.

without those clusters being thereby united. Single linkage is the first in the sequence, with k=1 and therefore no overlap, and represents the only situation where a hierarchic classification is derived. In the approach of assessing linkage diagrams under B_k rules, the clusters forming as one moves from a low to a high dissimilarity (distance) level are examined for the extent of linkage amongst their component OTUs in relation to linkages with other clusters. In the situation of discriminating taxa, evidence is sought for strong within-cluster linkage and of only limited between-cluster linkage and few OTUs in cluster overlap.

The method has been applied also in biogeographic and ecological analyses to explore commonality of distribution patterns and associations of species across samples (e.g. Holloway 1977, 1979; Davis et al. 2001). It offers a more sensitive method of recapturing information on clustering structure in data than other approaches such as averaging methods which are usually favoured because the results produced appear more clear-cut, but sometimes unjustifiably so because of their tendency to break chaining in the data structure rather than identify where it occurs.

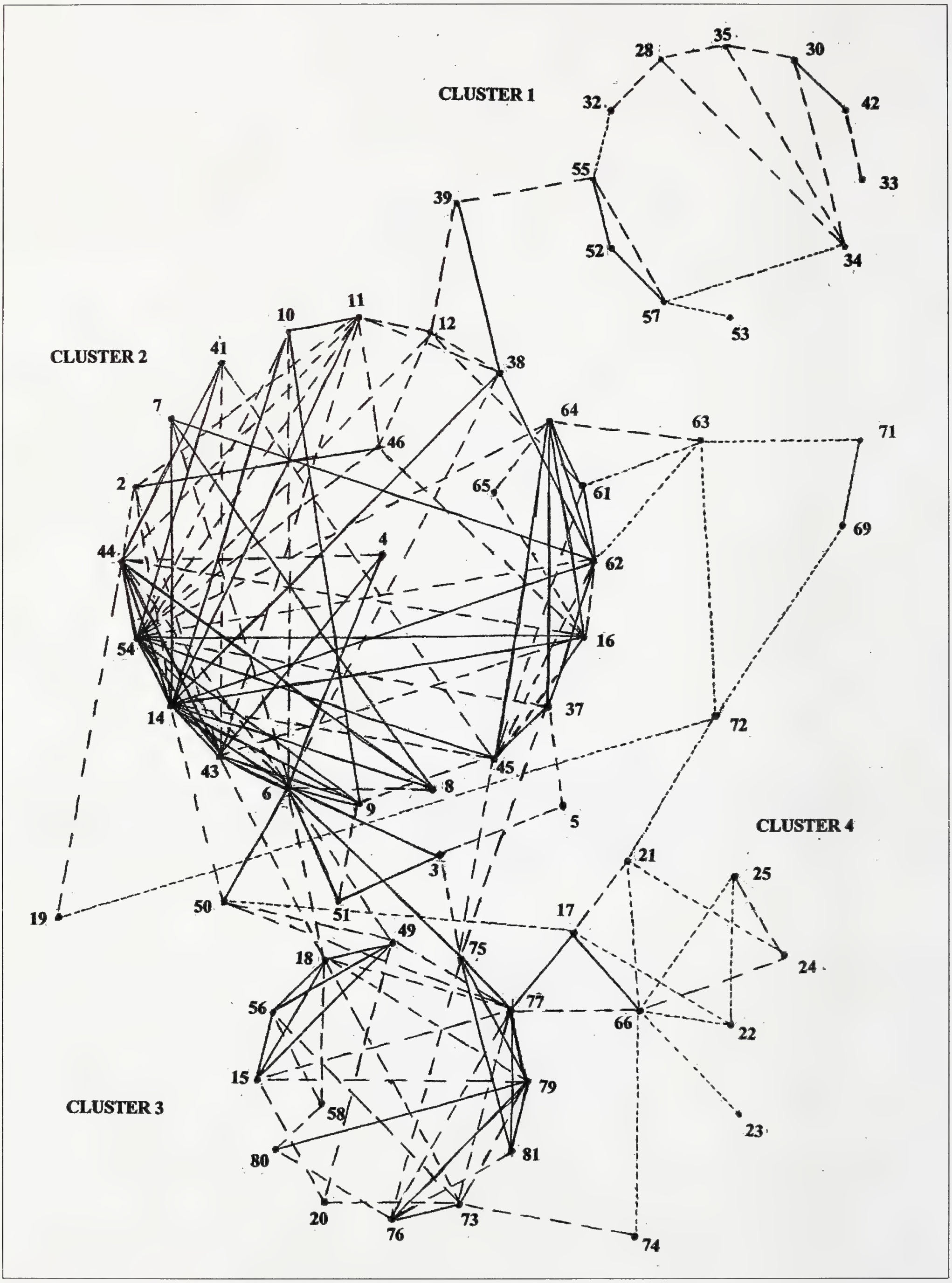

Fig. 5. Linkage diagram showing the links clustering 64 of the 82 specimens to a dissimilarity level of 0.40, although for clarity, only links to 0.35 are shown for Clusters 2 and 3. The additional links to 0.40 are predominantly within each of these two clusters, though 75 and 77 (two links) and 18 (seven links) in Cluster 3 show further affinity to Cluster 2 and could also be considered intermediate. Links to 0.30 are shown as solid lines, those to 0.35 as broken lines, and those to 0.40 outside clusters 2 and 3 as lines of small dashes. 18 of the next 22 links for Cluster 1 (except OTU 53) are interior to the cluster, supporting its distinctiveness and homogeneity.

Tab. 1. Measurements (mm) (means ± standard errors) of male genitalia in three *Hipparchia* taxa from six geographical localities. N = number of specimens.

Taxon & Locality	***H. semele* (UK) N=9**		***H. semele* (France/ Spain) N=9**		***H. muelleri* (S. Greece) N=8**		***H. delattini* (Kosovo) N=7**		***H. delattini* (N. Greece) N=8**	
Variable	**Mean**	**SE**	**Mean**	**SE**	**Mean**	**SE**	**Mean**	**SE**	**Mean**	**SE**
DL	3.24	0.03	3.76	0.08	3.48	0.07	3.75	0.07	3.58	0.05
VL1	2.47	0.05	2.99	0.06	3.01	0.04	3.19	0.06	3.14	0.03
VL2	0.54	0.02	0.63	0.02	0.71	0.02	0.74	0.03	0.74	0.02
VB1	0.46	0.02	0.48	0.02	0.47	0.02	0.42	0.03	0.42	0.02
VB2	0.51	0.02	0.51	0.01	0.51	0.01	0.47	0.03	0.58	0.01
UL	1.76	0.02	2.13	0.05	2.22	0.05	2.50	0.05	2.53	0.06
UB	0.16	0.01	0.15	0.01	0.23	0.01	0.20	0.01	0.23	0.01
BL	1.33	0.04	1.71	0.04	1.61	0.05	1.95	0.05	1.82	0.05
BB	0.26	0.01	0.31	0.02	0.35	0.01	0.38	0.02	0.34	0.01
TL	1.91	0.05	2.28	0.06	2.08	0.06	2.36	0.07	2.13	0.05
TB	1.28	0.03	1.43	0.02	1.24	0.03	1.34	0.04	1.24	0.04
PL	2.77	0.07	3.24	0.07	3.30	0.03	3.33	0.07	3.43	0.05
PB	0.29	0.02	0.34	0.01	0.31	0.01	0.29	0.01	0.30	0.01

All procedures, but the B_k cluster analysis, have been carried out in STATISTICA version 5.5 (Statsoft 1999). It was unnecessary to normalise the variables. Variables have been standardised for the PCA, DFA and k-means clustering and analysis has been carried on all 20 measurements and the seven ratios separately for the three (*H. semele*, *H. muelleri* and *H. delattini*) and two taxa (*H. semele* and *H. delattini*).

Results

Summary statistics are provided in Table 1 for geographical units with adequate samples rather than the taxa as these concepts of taxa may prove to be unsupported.

Principal components analysis. Table 2 and 3 record the eigenvalues and loadings for the 20 variables. The first two axes accounted for 47% of the variance; the distribution of variables and specimens in the axes are provided in Figs 2 and 3. Axis 1 primarily distinguished the majority of variables from *D*, the ratio of diagonal length (DL) to valve length (VL1). All but three variables (UB, *U* and *B*) have their highest loadings on the first two axes. Latitude increases in the same direction as *D*, whereas the majority of other variables are related to increasing longitude and altitude (Fig. 2). Latitude correlates significantly with 13 of the genitalia variables, longitude with 14 and altitude with 10 variables at $P < 0.05$ (11, 12 and 5 respectively with Bonferroni correction at $P < 0.0025$). The distribution of putative taxa correspond with this pattern; a clear gradient is established from *H. semele* through *H. muelleri* to *H. delattini*, the latter increasingly located in the direction of higher values (increased size) for most genitalia variables and with increasing longitude and altitude (Fig. 3).

Principal components of the 7 ratios produced much the same results (not tabulated). The first two axes accounted for 53% of the variance. All variables had their highest loadings on the first two axes. Axis 1 separated *V1*, *V2*, *T* and *P* (loadings –0.60 to

Tab. 2. Eigenvalues and extracted variables for the first 10 components of a principal components analysis on 20 genitalia variables (13 measurements and 7 ratios).

Component extracted	Eigenvalue	% Total variance	% Cumulative variance
1	6.715	33.58	33.58
2	2.727	13.63	47.21
3	2.394	11.97	59.18
4	1.769	8.85	68.03
5	1.308	6.54	74.57
6	1.213	6.07	80.64
7	1.065	5.32	85.96
8	0.976	4.88	90.84
9	0.518	2.59	93.43
10	0.470	2.35	95.78

Tab 3. Loadings for the first six axes of a principal components analysis of 20 genitalia variables (13 measurements and 7 ratios) in *Hipparchia* specimens (* supplementary to analysis. *Hipparchia* specimens include all 82 individuals in the study).

Variable	Axis 1	Axis 2	Axis 3	Axis 4	Axis 5	Axis 6
DL	-0.672	0.555	0.109	-0.219	-0.049	0.252
VL1	-0.941	0.180	-0.033	0.032	-0.065	-0.032
VL2	-0.760	0.002	-0.154	0.159	0.059	-0.161
VB1	0.137	0.576	-0.274	0.131	0.111	0.258
VB2	-0.117	0.558	-0.496	0.478	0.162	-0.065
UL	-0.837	0.022	0.095	0.211	0.139	-0.204
UB	-0.515	0.020	-0.687	-0.026	-0.219	0.012
BL	-0.812	0.232	0.184	0.079	0.023	-0.031
BB	-0.637	0.017	-0.172	-0.394	0.593	-0.040
TL	-0.656	0.339	0.311	-0.228	-0.042	0.380
TB	-0.132	0.594	0.548	0.116	0.184	-0.060
PL	-0.818	0.106	0.027	0.045	-0.175	-0.065
PB	0.030	0.581	-0.090	-0.518	-0.316	-0.491
D	0.609	0.381	0.163	-0.274	0.036	0.349
V1	-0.461	-0.441	0.443	-0.439	-0.199	0.062
V2	-0.706	-0.463	0.095	0.018	-0.075	-0.322
U	0.106	0.064	0.804	0.095	0.294	-0.172
B	0.008	0.229	0.393	0.533	-0.678	0.045
T	-0.504	-0.241	-0.209	-0.316	-0.228	0.425
P	-0.524	-0.450	0.096	0.496	0.171	0.416
*Latitude	0.607	0.038	0.297	0.134	0.050	0.071
*Longitude	-0.682	-0.247	-0.398	0.037	0.052	-0.064
*Altitude	-0.488	0.123	0.100	0.194	-0.032	-0.162

–0.83) from *D* (+0.76), and axis 2 distinguished variables *U* and *B* (+0.70 and +0.77) from the remainder (<0.20). Longitude, altitude and latitude are again polarised on Axis 1, with longitude (-0.66) and altitude (-0.34) relating to *V1*, *V2*, *T* and *P* and latitude (+0.50) to *D*. The distribution of taxa is similar to that from PCA on all variables, but *a priori* designated *H. muelleri* are offset from *H. semele* and *H. delattini* – a distribution reappearing in the NMMS plot of Mahalanobis's D^2 distances (Fig. 4) – rather than sandwiched between them, and linking up more with variable *T* rather than *V1*, *V2* and *P*.

Discriminant function analysis. ANOVA identified 17 of the 20 variables that significantly distinguished *a priori* labelled *Hipparchia* to the three taxa ($F_{(3,50)} = 2.82$ to 22.70, $P = 0.048$ to < 0.00001), 13 variables at $P < 0.0025$ (Bonferroni correction); the exceptions were VB2, TB and *V1*. Stepwise DFA of the 54 specimens that had been labelled (the others had not been assigned to a taxon prior to the classification; see Wakeham-Dawson et al. 2003) selected six variables (UB, UL, VB1, BB, BL and PL) that contributed to the discrimination. This results in 94% correct classification of specimens (Wilks's lambda = 0.136, $F_{(12,90)} = 12.81$, $P < 0.001$), with only three specimens being incorrectly classified. The parameters for variables are given in Table 4, the distances in Table 5 (lower diagonal) and the classification matrix in Table 6. An NMMS plot of Mahalanobis's D^2 distances between labelled specimens, including those not labelled, shows three clusters, each overlapping to a degree but with '*semele*' and '*delattini*' separated more than '*muelleri*' and '*semele*' (Fig. 4). The predicted classification of individuals not previously tagged is given in the Appendix together with a marker for those misclassified. Specimens classified as *H. delattini* are restricted to the Balkans but those determined to be *H. semele* occur as far east as 23°E and down the west side of the Balkans.

Stepwise discriminant function analysis for the three taxa based only on the seven ratios selected three variables that contributed to the discrimination of *a priori* designated individuals (*V2*, *U*, *B*). Significant discrimination was achieved (Wilks's lambda: 0.32, $F_{(6,98)}=12.443$, $P < 0.00001$) with 85.2% correct classification of designated individuals. *H. muelleri* was intermediate in distance between *H. semele* and *H. delattini* with all Mahalanobis's D^2 distances being significant (see Table 5, upper diagonal).

Further DFA for just two taxa (*H. semele* and *H. delattini*) based on the seven ratios selected three variables (*V2*, *V1*, *T*) that discriminated between individuals. Significant discrimination was achieved (Wilks's lambda = 0.35, $F_{(3,42)} = 25.52$, $P < .00001$) with 93.48% correct classification. *H. muelleri* specimens were regarded as unclassified prior to the analysis. Mahalanobis's D^2 between the two groups is = 7.65, $F_{(3,42)} = 25.40$, $P < 0.00001$. Individuals classified as *H. delattini* occurred as far west as 14°E and those classified as *H. semele* occurred as far east as 23°E. An interesting outcome is that of the collection of eight *H. muelleri* specimens from the same locality (22°E, 38°N), six were classified as *H. semele* (cases 12, 14–17, 19) and two as *H. delattini* (cases 18, 20).

K-means clustering. This technique resolved three main clusters based on three type individuals, group 1 *H. semele* (n = 15), group 2 *H. muelleri* (n = 42) and group 3

Tab. 4. Parameters for variables entered into stepwise (forward) discriminant function analysis of 54 specimens designated a priori to three *Hipparchia* taxa (Wilks's Lambda: 0.13632. $F_{(12,90)}=12.813$ $P < .00001$).

Variable	Wilks' lambda	Partial lambda	$F_{(2,45)}$ to remove	P level
VB1	0.190	0.718	8.82	0.0006
UL	0.167	0.817	5.04	0.0106
UB	0.235	0.579	16.35	0.0000
BL	0.177	0.769	6.75	0.0027
BB	0.166	0.821	4.90	0.0119
PL	0.162	0.841	4.25	0.0204

Tab. 5. Mahalanobis's D^2 between taxa for the 54 designated *Hipparchia* specimens (Lower triangle based on all genitalia variables; for comparison, the upper triangle is based on 7 ratio variables).

Taxa	*H. semele*	*H. muelleri*	*H. delattini*
H. semele	0.00	4.67	6.20
H. muelleri	10.27	0.00	4.27
H. delattini	14.70	10.25	0.00

Tab. 6. Classification matrix from discriminant function analysis of 54 specimens designated *a priori* to three *Hipparchia* taxa (Rows: observed classifications; columns: predicted classifications).

Group identity	Percent Correct	*H. semele*	*H. muelleri*	*H. delattini*
H. semele	92.86	26	2	0
H. muelleri	100.00	0	8	0
H. delattini	94.44	0	1	17
Total	94.44	26	11	17

H. delattini (n = 25). The distances between the groups and the accompanying ANOVA results are given in Tables 7 and 8. In phenetic (Euclidean) distances, group 2 is intermediate to groups 1 and 3, mirroring the PCA and DFA results. Fifteen variables have significant F values at $P < 0.05$; this number is still 14 with a Bonferroni correction. Nearly 65% of individuals were correctly assigned to the presumptive taxa. However this figure varied considerably among taxa, respectively 42.9% for *H. semele*, 75.0% for *H. muelleri* and 94.4% for *H. delattini* (Table 9). *H. semele*

Tab. 7. *K*-means clustering for three groups, Analysis of Variance

Variable	Between SS	Within SS	$F_{(2,79)}$	P
DL	28.564	52.436	21.517	<0.00001
VL1	53.195	27.805	75.571	<0.00001
VL2	35.114	45.886	30.227	<0.00001
VB1	4.737	76.263	2.454	0.093
VB2	6.434	74.566	3.408	0.038
UL	51.421	29.579	68.669	<0.00001
UB	17.968	63.032	11.260	0.00005
BL	45.110	35.890	49.648	<0.00001
BB	28.991	52.009	22.018	<0.00001
TL	27.136	53.864	19.899	<0.00001
TB	1.693	79.307	0.843	0.434
PL	45.402	35.598	50.378	<0.00001
PB	1.949	79.051	0.974	0.382
D	23.194	57.806	15.849	<0.00001
V1	12.340	68.660	7.099	0.0015
V2	39.150	41.850	36.952	<0.00001
U	0.940	80.060	0.464	0.631
B	1.227	79.773	0.608	0.547
T	19.601	61.399	12.610	0.00002
P	27.071	53.929	19.828	<0.00001

Tab. 8. *K*-means clustering for three groups, Euclidean distances between clusters (Distances below diagonal; squared distances above diagonal).

Groups	No. 1 (*H. semele*)	No. 2 (*H. muelleri*)	No. 3 (*H. delattini*)
No. 1 (*H. semele*)	0.000	0.760	2.366
No. 2 (*H. muelleri*)	0.872	0.000	0.539
No. 3 (*H. delattini*)	1.538	0.734	0.000

tended to be misclassified to *H. muelleri*, *H. muelleri* to *H. delattini* and *H. delattini* to *H. muelleri*. The groups were significantly different for geography and altitude with group number corresponding to the seeding by *H. semele*, *H. muelleri* and *H. delattini* respectively; specimens classified to *H. semele* occur to the north and west, and at the lower altitudes, those classified to *H. delattini* occur to the south and east, and at higher altitudes and specimens classified to *H. muelleri* occur at intermediate altitudes and geographical locations (Table 10). Even so, there is substantial geographical

Tab. 9. Summary (means and standard errors) for geographical variables of clusters from *k*-means clustering (ANOVA on normalized data; latitude: $F_{(2, 79)} = 19.23$, $P < 0.00001$; longitude: $F_{(2, 79)} = 29.84$, $P < 0.00001$; altitude: $F_{(2, 79)} = 11.79$, $P < 0.00003$).

Groups	No. 1 (*H. semele*)	No. 2 (*H. muelleri*)	No. 3 (*H. delattini*)	Total	% correct classification
*H. semele**	12	14	2	28	42.9
H. muelleri *	0	6	2	8	75.0
H. delattini *	0	1	17	18	94.4
Total	12	21	21	54	64.8

Tab. 10. Summary (means and standard errors) for geographical variables of clusters from *k*-means clustering (ANOVA on normalized data; latitude: $F_{(2, 79)} = 19.23$, $P < 0.00001$; longitude: $F_{(2, 79)} = 29.84$, $P < 0.00001$; altitude: $F_{(2, 79)} = 11.79$, $P < 0.00003$).

CLUSTER	Latitude		Longitude		Altitude	
	Mean	SE	Mean	SE	Mean	SE
No. 1 (*H. semele*)	47.83	1.12	4.83	1.96	453.33	163.55
No. 2 (*H. muelleri*)	42.88	0.51	15.70	1.01	683.33	80.43
No. 3 (*H. delattini*)	41.59	0.39	20.53	0.82	1102.00	97.83
All groups	43.39	0.42	15.18	0.89	768.90	63.84

Tab. 11. The geographic distribution of the *Hipparchia* specimens in each B_k cluster (see text for explanation).

Area	1	2	Intermediate 2/3	3	4	Loose outlying cluster 5	Outliers
Southern England (9)	7	0	1	0	0	0	1
Spain to French Alps (9)	0	7	1	0	0	1	0
Hungary, Romania (5)	0	5	0	0	0	0	0
Bavaria, Austria, Slovenia (10)	0	0	1	8	0	0	1
Croatia (Istria, Dalmatia [Croatia]) (10)	1	4	3	2	0	0	0
Serbia (10)	0	3	0	0	1	4	2
Corfu & Albania (5)	2	2	0	0	1	0	0
N.W. Greece (Epiros) (6)	0	4	1	1	0	0	0
N. Greece (Naoussa) (8)	0	1	0	0	6	1	0
S. Greece (Mt. Chelmos) (8)	0	4	0	3	1	0	0
Greece (Kevi) (2)	0	0	0	0	0	1	1
Total (82)	10	30	7	14	9	7	5

overlap based on all 82 specimens with *H. delattini* designated specimens being found as far west as 2° East and *H. semele* designated specimens being found as far east as 22° East.

Running *k*-means clustering for two groups, seeded with the *H. semele* and *H. delattini* specimens, rather than three is highly instructive. Sixteen variables provide significant group differentiation at $P < 0.05$ and 14 variables at $P < 0.0025$. There is 91.3% correct classification of *H. semele* and *H. delattini*, the two taxa used to seed the two groups. All *H. delattini* are correctly classified and all but four of the 24 *H. semele*. The eight *H. muelleri* are allocated to group 2 (*H. delattini*). In the $k = 2$ solution, there is as much geographical overlap of all 82 specimens as in the $k = 3$ means clustering solution, despite the fact that they again differ for longitude, altitude and latitude (t test; $t_{(80)}$: latitude 6.14, longitude –6.60, altitude -4.90; all $P < 0.00001$). Group 1 (seeded with *H. semele*) occur eastwards to 20°E and Group 2 (seeded with *H. delattini*) occur west to 2°E.

B_k analysis. This produces four main clusters, and a number of clusters that are not so well defined (Fig. 5). Cluster 1 includes nominal *H. semele* specimens from southern England and three from the Balkans. These specimens are: awd279 (28), awd281 (30), awd283 (32), awd284 (33), awd285 (34), awd286 (35), awd287 (42), bmnh13377 (52), bmnh13374 (55), and bmnh29808 (57). See Appendix for capture locations. Numbers in parenthesis are those allocated to each specimen during cluster analysis and used in Figs 3 & 4. Cluster 2 largely contains Balkan specimens, including most of the *H. muelleri* topotypes and some unidentified specimens. These specimens are: bmnh29865 (2), bmnh29867 (4), bmnh29872 (6), bmnh29869 (7), bmnh29874 (8), bmnh29875 (9), bmnh29871 (10), bmnh29868 (11), awd127 (12), awd382 (14), awd386 (16), awd316 (37), awd288 (38), and awd289 (39). Cluster 2 has some peripheral specimens; these are: bmnh11994 (1), awd247 (13), awd392 (19), awd427 (59), awd428 (60), and pj115 (63). Cluster 2 links through intermediates with Cluster 3; this includes *H. muelleri* topotypes and nominal *H. semele* specimens. These are specimens: awd383 (15), awd391 (18), awd393 (20), jdh60 (49), bmnh29807 (56), bmnh29809 (58), pj61 (73), pj62 (74), pj63 (75), pj64 (76), pj65 (77), pj67 (79), pj68 (80), pj70 (81). Specimens: bmnh29866 (3), bmnh29870 (5), awd282 (31), awd315 (36), jdh 59 (50), bmnh13378 (51), and pj66 (78) are those intermediate between Clusters 2 and 3. Cluster 4 contains nominal *H. delattini* specimens from North Greece and an *H. delattini* topotype from Pristina, Kosovo. These are specimens: awd387 (17), awd394 (21), awd396 (22), awd398 (23), awd399 (24), awd400 (25), and pj118 (66). Specimens: awd401 (26) and bmnh13375 (53) are peripheral to Cluster 4. An additional loose cluster (Cluster 5) contains a mix of specimens that includes *H. delattini* topotypes from Pristina, Kosovo. These are specimens: pj121 (69), pj123 (71), pj124 (72), awd402 (27), awd292 (40), awd356 (48), and pj122 (70). Specimens: awd280 (29), awd355 (47), pj119 (67), pj120 (68), and pj71 (82) are extreme outliers. These clusters show some geographical segregation, although the sample size for each geographic region in Table 11 is small.

A DFA (based on the genitalia measurements and shape ratios) of the specimens identified in the five main B_k clusters confirms the integrity of these clusters by showing segregation of the clusters (Wilks's lambda = 0.008, $F_{(32,185)} = 15.45$, $p < 0.001$) and 95% correct classification of specimens within clusters (variables UL, DL, PL, *U*, BL, TB, BB and *B* retained in the stepwise forward entry analysis). However, there is some overlap between clusters, especially if only ratios are used in a DFA (Wilks's lambda = 0.387, $F_{(12,145)} = 5.25$, $p < 0.001$; 55% correct classification of specimens within clusters; ratios *D*, *U* and *T* retained in the stepwise forward entry analysis), so size is an important factor in segregating specimens. PCA and DFA on the clusters failed to identify just which variables might be used to distinguish individuals to groups as Clusters 1 and 2 did not separate neatly from Clusters 3 and 4. However, PCA suggests that *H. semele* specimens from southern England (Cluster 1) are largely distinct from the three southern European *H. semele* (also included in Cluster 1) because of genital shape differences as well as size difference.

When B_k clusters are presented visually (Fig. 5), the nominal *H. semele* specimens from southern Europe are grouped into Clusters 2 & 3 with the nominal *H. muelleri* specimens. The nominal *H. semele* specimens from southern England (Cluster 1) are segregated to one side of Cluster 2 and nominal *H. delattini* specimens (Cluster 4) from North Greece and Kosovo are segregated to the other side.

Discussion

This study was generated by questions concerning the number of *Hipparchia* taxa in the Balkans, particularly on the existence of one or two *Hipparchia* species closely related to *H. semele*. A number of findings emerge. First, clusters for the three taxa, *H. semele*, *H. muelleri* and *H. delattini*, are repeatedly found in all analyses based on genital morphology; in the PCA, DFA, NMMS of Mahalanobis's D^2 distances, the *k*-means clustering and the B_k clustering. Second, even so, the clusters merge and are not so distinct that every individual can be categorised unequivocally to one of the *three* taxa, certainly not on individual genital morphology and with even less success for genital ratio variables which control for differences in absolute size. Overlap occurs for the putative taxa in PCA, the NMMS plot of Mahalanobis's D^2 distances and B_k clustering and incorrect classification occurs in DFA and *k*-means clustering. Third, from the highly significant associations of genital morphology with longitude, latitude and altitude, there is a strong suggestion of a gradient (cline) in genital morphology. In this, *H. muelleri* largely adopts an intermediate position between *H. semele* and *H. delattini*, but not exactly an intermediate position for all genital attributes as evident in the PCA of ratio data. Just whether *H. muelleri* is more closely associated with *H. semele* or *H. delattini* depends on the analysis being applied and which variables are used. For example, DFA on two groups for ratios links *H. muelleri* more with *H. semele*, but *k*-means clustering for $k = 2$ on ratios allocates *H. muelleri* to *H. delattini*.

Fourth, despite the apparent cline for many variables in genital morphology, classification (DFA, *k*-means clustering) reveals a geographical overlap of taxa, regardless of whether two or three groups are considered. The overlap is greater for *k*-means clustering than for DFA; the reason for this is that, in the absence of distinct morphological boundaries between the taxa being considered, *k*-means clustering has shifted the morphological boundary between them into *H. semele*; that is, more *a priori* designated *H. semele* are misclassified than *H. delattini* and the latter has grown in number and geographical range (expanding westwards) at the expense of the former. A more conservative picture is provided by DFA on two groups for ratios. This shows that *H. delattini* extends no further west than 14°E but that *H. semele* extends eastwards to 23°E. It is a more reliable picture since complications associated with *H. muelleri* are removed and genital comparisons are based on ratios, not purely on size aspects on genital morphology.

Arising, then, from this analysis is the possibility of two *Hipparchia* taxa present in the Balkan study area, a finding greatly in need of confirmation from more extensive sampling and DNA markers. Broadly, these are *H. semele* and *H. delattini* (which includes *H. muelleri*-like forms). Kudrna (1975) originally described *H. muelleri* as a subspecies of *H. semele*; on the whole, we find *H. muelleri* to be closer to *H. delattini* than to *H. semele* in male genital morphological space. The two species may have broader distributions (geographical ranges) than previously considered. *H. delattini*, which is probably conspecific with Russian *H. volgensis* (see Kudrna, 1977), appears to be largely confined to the Balkans and Northern Greece. *H. semele* is present in western Europe, but also into the Balkans. The complexity of some clusters (clusters 2 and 3) in B_k clustering may point towards hybridisation between the two taxa.

The suggested relationship between taxa and altitude accords with the findings of Pamperis (1997), who recorded *H. muelleri* at low to intermediate altitudes and *H. delattini* (synonymised with *H. volgensis*) at intermediate to higher altitudes in Greece. However, it should be noted that the validity of Pamperis' wing-pattern based method of taxa identification has been questioned by Wakeham-Dawson & Kudrna (2000).

The two apparent taxa of the current study may be the product of speciation during isolation in ice-age refugia; other species conform to this east versus west European pattern (see Dennis et al. 1991; Dennis 1993; Hewitt 1999, 2000; Schmitt & Seitz 2001a, b). This model would describe the different taxa evolving in western (*H. semele*) and eastern (*H. delattini* or *H. volgensis*) regions at Mediterranean latitudes and recolonising northern areas in Europe and coming into contact following each glacial stage. Subsequent glacial advances tend to erase populations north of the Alps in which case genetic differentiation is maintained and enhanced during glacial-interglacial cycles (Dennis et al. 1991). Examples of similar 'cryptic' taxa are provided by sibling species groups of *Maniola jurtina* (Linnaeus, 1758) (Thomson 1987), *Pontia daplidice* (Linnaeus, 1758) and *P. edusa* (Fabricius, 1777) (Geiger et al. 1988) and *Leptidea reali* Reissinger, 1989 and *L. sinapis* (Linnaeus, 1758) (Mazel 2001), the last of which comprises components that extensively overlap in geographical range. The two taxa hypothesis produced by the current study is supported by a study of female genitalia (Coutsis 1983), which shows a clear disjunction in morphology between *H. semele* and *H. delattini*. Coutsis (1983) groups *H. muelleri* with *H. delattini* based on female genital morphology, corresponding with the closer relationship found here for *H. muelleri* and *H. delattini* than that for *H. muelleri* and *H. semele* based on male genital attributes. No significant difference was found in the morphology of *H. muelleri* and *H. delattini* androconia (Wakeham-Dawson 1998). Even so, in all analyses of male genitalia, there is failure to discriminate absolutely between the three taxa investigated here, and *H. muelleri* emerges as being approximately equidistant from *H. delattini* and *H. semele* in phenetic distances.

The issue arises that variation in male genitalia may not be a reliable taxonomic characteristic. Any structure that is not critical during copulation will probably not be under powerful sexual selection and so will not be a reliable indicator of reproductive isolation between taxa. If this is the case, genital shape may be neutral to selection and subject only to random processes, or to pleiotropic effects. In another satyrine butterfly, *Maniola jurtina* Linnaeus, 1785, there is an absence of an apparent relationship between valve shape and either mating success or strength of the male-female bond (Goulson 1993). However, both valve shape and uncus are much larger in species with a sphragis (e.g., *Heteronympha penelope* Waterhouse (Lepidoptera: Satyridae), and this may be an adaptation to sphragis removal during mating (Orr 2002).

Specimens, which are as yet unmeasured, from Bulgaria, appear to exhibit two clear forms of male genitalia (valve shape) that associate more definitely with *H. semele* or *H. delattini* (S. Abadijev, loan material) than do most specimens from the Balkans. The next stage in this research is: (1) to test the two-taxa (*semele* and *volgensis*) hypothesis with further specimens from across Europe including the Balkans and eastwards into Bulgaria and Russia, and (2) to assess the morphological data against molecular data.

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Appendix. Label data of the 82 *Hipparchia* specimens included in the current study. Sp. no. = specimen number; Case no. = cluster number used in cluster diagrams and Figs 3 & 4. Taxon: ? (specimens of uncertain taxonomic attribution) determined by discriminant function analysis; classification noted as 's' *semele*, 'm' *muelleri* or 'd' *delattini*. The three individuals misclassified and their reclassification are indicated by appropriate letter. Specimens deposited at The Natural History Museum, London (BMNH), the collection of A. Wakeham-Dawson (AWD), the collection of P. Jakšić (PJ), the collection of J. D. Holloway (JDH), and the Booth Museum, Brighton (BMB).

sp. no. (Case no.)	Taxon	Country	Location	Notes
bmnh11994 (1)	? m	Italy	Gorizia, La Logua	BMNH
awd127 (12)	muelleri	S. Greece	Mount Chelmos, Pelopónnisos	1300 m, 15.vii.1995, AWD
bmnh13374 (55)	? s	N. Greece	Corfu	BMNH
bmnh13375 (53)	? m	N. Greece	Corfu	BMNH
bmnh13376 (54)	? m	N. Greece	Corfu	BMNH
bmnh13377 (52)	? s	Albania	Tepelenë	16.vi.1933, leg. A.H.G Alston & N.Y. Sandwith, BM 1932-383, BMNH
bmnh13378 (51)	? m	Croatia	Perkovic	12.vi.(19)08, H. Stauder, Fruhstorfer, Coll., BM 1987 285, BMNH
awd247 (13)	delattini m	Macedonia	Séli, Náoussa	1500-1600 m, 21.vi.1996, AWD
awd279 (28)	semele	England	Eastbourne, Sussex	200 m, 4.viii.1996, AWD
awd280 (29)	semele	England	Eastbourne, Sussex	200 m, 4.viii.1996, AWD
awd281 (30)	semele	England	Eastbourne, Sussex	200 m, 4.viii.1996, AWD
awd282 (31)	semele	England	Eastbourne, Sussex	200 m, 4.viii.1996, AWD
awd283 (32)	semele	England	Eastbourne, Sussex	200 m, 4.viii.1996, AWD
awd284 (33)	semele	England	Eastbourne, Sussex	200 m, 4.viii.1996, AWD
awd285 (34)	semele	England	Eastbourne, Sussex	200 m, 4.viii.1996, AWD
awd286 (35)	semele	England	Eastbourne, Sussex	200 m, 4.viii.1996, AWD
awd287 (42)	semele	England	Eastbourne, Sussex	200 m, 4.viii.1996, AWD
awd288 (38)	semele	France	Mount Canigou, E. Pyrenees	2200 m, 28.vii.1993, AWD
awd289 (39)	semele	France	Les Arcs, Alps	2600 m, 1.viii.1993, AWD
awd292 (40)	semele	France	Prades, E. Pyrenees	1000 m, 17.vii.1990, AWD
bmnh29807 (56)	? s	Croatia	Knin	July (19)08, Fruhstorfer, Coll., BM 1987-285, BMNH
bmnh29808 (57)	? m	Croatia	Dernis	10.vi.(19)08, H. Stauder, Fruhstorfer, Coll., BM 1987-285, BMNH
bmnh29809 (58)	? s	Croatia	Perkovic	12.vi.(19)08, H. Stauder, Fruhstorfer, Coll., BM 1987-285, BMNH
bmnh29865 (2)	? m	Italy	Venezia Giulia, Costa Trieste	13.vii.1926, BMNH
bmnh29866 (3)	? m	Italy	Littorale austr.	H. Stauder, 17.vi.1912, BMNH
bmnh29867 (4)	? m	Croatia	St Kriz	12.vii.1912, BMNH
bmnh29868 (11)	? s	Romania	Biharfüred, Bihar Mts	800-1200 m, K. Jordan, 20.vii.1911, BMNH
bmnh29869 (7)	? m	Romania	Herkulesbad	W. R. & E. H., 25.vii.1907, BMNH
bmnh29870 (5)	? d	Croatia	Senjska drega	17.vii.1912, BMNH
bmnh29871 (10)	? s	Hungary	Szovata, Maros-Torda c.	27.vii.1910, BMNH
bmnh29872 (6)	? s	Croatia	Zengg	1913, BMNH
bmnh29874 (8)	? s	Romania	Herkulesbad	21.vii.1907, BMNH
bmnh29875 (9)	? s	Romania	Herkulesbad	W. R. & E. H., 25.vii.1907, BMNH
awd315 (36)	semele	Spain	Albaraccin	1000 m, 20-23.vi.1995, AWD
awd316 (37)	semele	Spain	Albaraccin	1000 m, 20-23.vi.1995, AWD

sp. no. (Case no.)	Taxon	Country	Location	Notes
awd355 (47)	? d	N. Greece	Kevi	22.vi.1981, P.W. Cribb Coll. (Acc. no. 094732) BMB
awd356 (48)	? m	N. Greece	Kevi	22.vi.1981, P.W. Cribb Coll. (Acc. no. 094733) BMB
awd382 (14)	muelleri	S. Greece	Mount Chelmos, Pelopónnisos	1350-1600 m, 14.vi.1997, AWD
awd383 (15)	muelleri	S. Greece	Mount Chelmos, Pelopónnisos	1350-1600 m, 14.vi.1997, AWD
awd386 (16)	muelleri	S. Greece	Mount Chelmos, Pelopónnisos	1300 m, 13.vi.1997, AWD
awd387 (17)	muelleri	S. Greece	Mount Chelmos, Pelopónnisos	1350-1600 m, 14.vi.1997, AWD
awd391 (18)	muelleri	S. Greece	Mount Chelmos, Pelopónnisos	1300 m, 13.vi.1997, AWD
awd392 (19)	muelleri	S. Greece	Mount Chelmos, Pelopónnisos	1350-1600 m, 14.vi.1997, AWD
awd393 (20)	muelleri	S. Greece	Mount Chelmos, Pelopónnisos	1350-1600 m, 14.vi.1997, AWD
awd394 (21)	delattini	N. Greece	Séli, Náoussa, Macedonia	1500-1600 m, 25-26.vi.1997, AWD
awd396 (22)	delattini	N. Greece	Séli, Náoussa, Macedonia	1500-1600 m, 25-26.vi.1997, AWD
awd398 (23)	delattini	N. Greece	Séli, Náoussa, Macedonia	1500-1600 m, 25-26.vi.1997, AWD
awd399 (24)	delattini	N. Greece	Séli, Náoussa, Macedonia	1500-1600 m, 25-26.vi.1997, AWD
awd400 (25)	delattini	N. Greece	Séli, Náoussa, Macedonia	1500-1600 m, 25-26.vi.1997, AWD
awd401 (26)	delattini	N. Greece	Séli, Náoussa, Macedonia	1500-1600 m, 25-26.vi.1997, AWD
awd402 (27)	delattini	N. Greece	Séli, Náoussa, Macedonia	1500-1600 m, 25-26.vi.1997, AWD
awd427 (59)	semele	France	Lozère	W.G. & S.M. Tremewan, 1000 m, 15.vii.1998, AWD
awd428 (60)	semele m	France	Lozère	W.G. & S.M. Tremewan, 1000 m, 15.vii.1998, AWD
awd429 (61)	semele	France	Lozère	W.G. & S.M. Tremewan, 1000 m, 15.vii.1998, AWD
awd430 (62)	semele	France	Lozère	W.G. & S.M. Tremewan, 1000 m, 15.vii.1998, AWD
cfu350 (41)	? m	Greece	Corfu	Ex coll. D & S. Howell, AWD
jdh20 (46)	? m	N.W. Greece	4 km w. of Spartos (e. of Vonitsa)	26.viii.1963, JDH
jdh23 (43)	? m	N. Greece	Dodoni, sw. of Konitsa	JDH
jdh24 (44)	? m	N. Greece	Aristi, SW. of Konitsa	13.vi.1977, JDH
jdh51 (45)	? s	N. Greece	Mesovounion, between Konitsa and Ioánnina	June 1984, JDH
jdh59 (50)	? d	N. Greece	Ioánnina	open hillside, June 1984, JDH
jdh60 (49)	? s	N. Greece	Ioánnina	open hillside, June 1984, JDH
pj61 [BDR-365] (73)	semele	Germany	Bavaria, Fohrenheide Gebiet	15.7.1973, H. Weigel, PJ
pj62 [BDR-363] (74)	semele	Germany	Bavaria mer., Eching	28.7.1951, P. Hotler, PJ
pj63 [BDR-364] (75)	semele	Germany	Bavaria mer., Eching	28.7.1951, P. Hotler, PJ
pj64 [BDR-362] (76)	semele	Germany	Bavaria mer., Eching	28.7.1951, P. Hotler, PJ

sp. no. (Case no.)	Taxon	Country	Location	Notes
pj65 [AUS-1274] (77)	semele m	Austria	Marchfeld, Oberweiden	date?, O. Wagner, PJ
pj66 [slov-412] (78)	semele	Slovenia	Slavnik	500m, 29.7.1976, B. Mihljevic, PJ
pj67 [slov-432] (79)	semele	Slovenia	Postojna	9.8.1931, M. Hafner, PJ
pj68 [slov-430] (80)	semele	Slovenia	Sorsko polje	9.8.1931, M. Hafner, PJ
pj70 [slov-422] (81)	semele	Slovenia	Opatija	25.6.1948, S. Michieli, PJ
pj71 [slov-428] (82)	semele	Slovenia	Ankaran	20-30.6.1959, S. Michieli, PJ
pj115 [kos-6/7277] (63)	delattini	Serbia	Pristina, Grmija	700 m, 25.6.1979, P. Jaksic, PJ
pj116 [kos-2249] (64)	delattini	Serbia	Prizen	950 m, 22.8.1994, P. Jaksic, PJ
pj117 [kos-5/6293] (65)	delattini	Serbia	Pristina, Grmija	700 m, 19.9.1979, P. Jaksic, PJ
pj118 [kos-6/7709] (66)	delattini	Serbia	Pristina, Grmija	700 m, 9.9.1979, P. Jaksic, PJ
pj119 [kos-6/7340] (67)	delattini	Serbia	Pristina, Grmija	700 m, 6.7.1979, P. Jaksic, PJ
pj120 [kos-6/7341] (68)	delattini	Serbia	Pristina, Grmija	700 m, 6.7.1979, P. Jaksic, PJ
pj121 [kos-1185] (69)	delattini	Serbia	Sar-planina, Piribeg	1700m, 3-4.8.1987, P. Jaksic, PJ
pj122 [kos-439 b] (70)	delattini	Serbia	Pristina, Grmija	700 m, 15.6.1979, P. Jaksic, PJ
pj123 [kos-5637] (71)	delattini	Serbia	Pristina, Grmija	700 m, 5.9.1976, P. Jaksic, PJ
pj124 [kos-1189] (72)	delattini	Serbia	Kopaonik, Sipacine	1200 m, 19.7.1985, P. Jaksic, PJ

Nepticulidae from the Volga and Ural region

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Abstract. The Nepticulidae of the Russian provinces (oblasts) Ul'yanovsk, Samara, Saratov, Volgograd, Astrakhan and Chelyabinsk and the Kalmyk Republic are listed. We record 60 species, including two only previously recorded, 28 species only on the basis of leafmines (indicated with an *). Seventeen species are recorded as new for Russia. Eleven of these are reported on the basis of adults: *Stigmella glutinosae* (Stainton, 1858), *S. ulmiphaga* (Preissecker, 1942), *S. thuringiaca* (Petry, 1904), *S. rolandi* Van Nieukerken, 1990, *S. hybnerella* (Hübner, 1813), *Trifurcula* (*Trifurcula*) *subnitidella* (Duponchel, 1843), *T.* (*T.*) *silviae* Van Nieukerken, 1990, *T.* (*T.*) *beirnei* Puplesis, 1984, *T.* (*T.*) *chamaecytisi* Z. & A. Laštůvka, 1994, *Ectoedemia* (*Zimmermannia*) *liebwerdella* Zimmermann, 1940 and *Ectoedemia* (*Ectoedemia*) *caradjai* (Groschke, 1944). Six species are reported on the basis of mines only: *Stigmella freyella* (Heyden, 1858), *S. nivenburgensis* (Preissecker, 1942), *S. paradoxa* (Frey, 1858), *S. perpygmaeella* (Doubleday, 1859), *Ectoedemia* (*Ectoedemia*) *atricollis* (Stainton, 1857) and *E. spinosella* (Joannis, 1908). *Astigmella dissona* Puplesis, 1984 is synonymised with *Stigmella naturnella* (Klimesch, 1936), here recorded for European Russia for the first time, bridging the gap between Far East Russia and Europe. *S. juryi* Puplesis, 1991 is synonymised with *S. paradoxa* (Frey, 1858). *S. zelleriella* (Snellen, 1875) is found in a stream valley in steppe area, probably associated with *Salix triandra*, a different host in habitat that differs widely from other occurrences. *S. obliquella* (Heinemann, 1862) is for the first time recorded from European Russia. A few new records outside this area are cited under distribution, including *Ectoedemia* (*Fomoria*) *weaveri* (Stainton, 1855) recorded from Magadan in the Far East.

Zusammenfassung. Es wird ein Verzeichnis der Nepticulidae der Russischen Provinzen (Oblasten) Uljanowsk, Samara, Saratow, Wolgograd, Astrachan und Tscheljabinsk sowie aus der Kalmykkischen Republik gegeben. Insgesamt sind 60 Arten (inklusive zwei in früherer Zeit angegebene) enthalten, wovon 28 nur durch Blattminen belegt sind (in der Zusammenstellung mit dem Symbol * markiert). Siebzehn Arten sind neu für Russland, davon wurden elf als Imagines gefunden: *Stigmella glutinosae* (Stainton, 1858), *S. ulmiphaga* (Preissecker, 1942), *S. thuringiaca* (Petry, 1904), *S. rolandi* Van Nieukerken, 1990, *S. hybnerella* (Hübner, 1813), *Trifurcula* (*Trifurcula*) *subnitidella* (Duponchel, 1843), *T.* (*T.*) *silviae* Van Nieukerken, 1990, *T.* (*T.*) *beirnei* Puplesis, 1984, *T.* (*T.*) *chamaecytisi* Z. & A. Laštůvka, 1994, *Ectoedemia* (*Zimmermannia*) *liebwerdella* Zimmermann, 1940 und *Ectoedemia* (*Ectoedemia*) *caradjai* (Groschke, 1944). Von sechs Arten wurden nur Blattminen gefunden: *Stigmella freyella* (Heyden, 1858), *S. nivenburgensis* (Preissecker, 1942), *S. paradoxa* (Frey, 1858), *S. perpygmaeella* (Doubleday, 1859), *Ectoedemia* (*Ectoedemia*) *atricollis* (Stainton, 1857) und *E. spinosella* (Joannis, 1908). *Astigmella dissona* Puplesis, 1984 wird synonymisiert mit *Stigmella naturnella* (Klimesch, 1936). Diese Art wird hier zum ersten Mal aus dem europäischen Teil Russlands gemeldet, wodurch die große Verbreitungslücke zwischen Mitteleuropa und dem Fernen Osten geschlossen wird. *S. juryi* Puplesis, 1991 wird synonymisiert mit *S. paradoxa* (Frey, 1858). *S. zelleriella* (Snellen, 1875) wurde in einem Bachtal im Steppenbereich gefunden und ist dort wahrscheinlich trophisch mit *Salix triandra* assoziiert, lebt hier also im Vergleich zu den anderen bekannten Vorkommen an einer anderen Futterpflanze und in einem sehr verschiedenartigen Habitat. Auch *S. obliquella* (Heinemann, 1862) wird hier zum ersten Mal aus dem europäischen Teil Russlands gemeldet. Die Verbreitungsangaben enthalten auch einige Neumeldungen außerhalb dieses Gebietes, darunter *Ectoedemia* (*Fomoria*) *weaveri* (Stainton, 1855) aus Magadan im Fernen Osten.

Резюме. Приведен список молей-малюток Ульяновской, Самарской, Саратовской, Волгоградской, Астраханской, Челябинской областей и Республики Калмыкия. Из 60 отмеченных видов лишь 2 были приведены предшествующими исследованиями; 28 видов приведены на основании характерных листовых мин (отмечены в тексте статьи звездочкой *). 17 видов приведены как новые для фауны России, 11 из них отмечены на имагинальной фазе (*Stigmella glutinosae* (Stainton, 1858), *S. ulmiphaga* (Preissecker, 1942), *S. thuringiaca* (Petry, 1904), *S. rolandi* Van Nieukerken, 1990, *S. hybnerella* (Hübner, 1813), *Trifurcula* (*Trifurcula*) *subnitidella* (Duponchel, 1843), *T.* (*T.*) *silviae* Van Nieukerken, 1990, *T.* (*T.*) *beirnei* Puplesis, 1984, *T.* (*T.*) *chamaecytisi* Z. & A. Laštůvka, 1994, *Ectoedemia* (*Zimmermannia*) *liebwerdella* Zimmermann, 1940 и *Ectoedemia* (*Ectoedemia*) *caradjai* (Groschke, 1944)); 6 видов – только на основании мин: *Stigmella freyella*

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(Heyden, 1858), *S. nivenburgensis* (Preissecker, 1942), *S. paradoxa* (Frey, 1858), *S. perpygmaeella* (Doubleday, 1859), *Ectoedemia* (*Ectoedemia*) *atricollis* (Stainton, 1857) и *E. spinosella* (Joannis, 1908). *Astigmella dissona* Puplesis, 1984 синонимизируется с *Stigmella naturnella* (Klimesch, 1936), впервые отмечаемой для Европейской России и закрывающей таким образом ранее существовавший пробел в распространении вида между Западной Европой и Дальним Востоком России. *S. juryi* Puplesis, 1991 синонимизируется с *S. paradoxa* (Frey, 1858). *S. zelleriella* (Snellen, 1875) обнаружена на берегу ручья в глинистой степи, где, вероятно, связана с *Salix triandra*, новым для нее кормовым растением в данном биотопе, резко отличном от известных. Также впервые для Европейской России приводится вид *S. obliquella* (Heinemann, 1862). Несколько новых находок за пределами изучаемого региона обсуждаются в данных по распространению: *Ectoedemia* (*Fomoria*) *weaveri* (Stainton, 1855) отмечается из-под Магадана.

Key words. Russia, faunistics, new records, new synonymy, *Stigmella*, *Ectoedemia*, *Bohemannia*, *Trifurcula*.

Ключевые слова. Россия, фаунистика, новые находки, новая синонимия, *Stigmella*, *Ectoedemia*, *Bohemannia*, *Trifurcula*.

Introduction

The leafmining moth family Nepticulidae is relatively poorly known from large parts of Russia. Previous research has concentrated on the fauna of the far eastern Primorskiy Kray, the former Soviet republics of Central Asia and the Crimea in Ukraine (Puplesis 1994). In his book Puplesis lists many species from the European part of Russia, but gives very few pertinent records. Also in the earlier faunal treatment of the larvae (Gerasimov 1952) no detailed records were given, and for many species the only indication of distribution is 'European part of the Soviet Union'. Such records could also have been referring to Ukraine, Byelorussia or the Baltic republics. Hence, the occurrence in Russia is often not clear.

There is a number of faunistic papers which deal with some species of Nepticulidae from a few provinces (regions) in the European part of Russia, the northwest being comparatively well investigated: Murmansk (Kozlov & Jalava 1994; Kozlov et al. 2000), Karelia (Kutenkova 1986, 1989) and a checklist for Leningrad (Jürivete et al. 2000). In the west, Nepticulidae are recorded from Smolensk, Bryansk (Skala 1944) and Kaluga (Shmytova 2001, 2002). Other scattered records can be found in some ecological studies (Kozlov 1996; Kozlov & Koricheva 1990, 1991). A few mines have also been reported from the Caucasus and Black Sea Coast (Utech 1962).

For the lower and middle Volga region, there are very few published records for Nepticulidae. Surprisingly no species were listed by Eversmann (1844). Another well know 19th century lepidopterist working in this area, Hugo Christoph, did not publish any nepticulid record, but he collected a few specimens near Sarepta (Volgograd), which are now in the Natural History Museum in London; they have been studied by the senior author and are listed here. A few species were recorded from the upper Volga reaches in Tatarstan (Kazan district) (Krulikowsky 1908). Further Puplesis recorded *Stigmella kazakhstanica* Puplesis, 1991 from Astrakhan (Puplesis et al. 1991) (but see below under *S. ulmiphaga*), *Trifurcula* cf. *puplesisi* Van Nieukerken, 1990 was recorded from Sarepta (Krasnoarmeysk) (van Nieukerken 1990) and *T. pallidella* (Duponchel, 1843) from the Saratov region (Puplesis 1994). More recently, Sachkov et al. (1997) list several miners from the Zhiguli Nature reserve in the Samara region and Anikin (2001) lists three species from the Volga region, including the already cited *T. pallidella* and *S. kazakhstanica*.

The junior authors and several colleagues extensively collected Lepidoptera in the Volga and Ural region, results of which have partly been published by Anikin et al. (1993). Adult Nepticulidae and many mines were collected in the Ul'yanovsk and Samara provinces, middle Volga, but a few adults have also been collected in Saratov, Volgograd and Astrakhan in the lower Volga valley and mines were also collected in the Kalmyk republic. We also include the record of just two specimens taken in the southern Ural (Cheliabinsk) during recent Russian-Finnish expeditions (Ahola et al. 1997; Nupponen et al. 2000).

During all these studies, 30 species of Nepticulidae were collected as adults and in addition the mines of 28 other identifiable species were found (plus mines of some species recorded as adults as well). With the previously recorded (uncertain) *S. kazakhstanica* and *T. puplesisi*, the total is 60 species of Nepticulidae. Although this is in all probability only a small portion of the actual fauna of the region (estimated to be at least 100 species), we publish these records here, since they provide interesting biogeographical data. At least 17 species are new for Russia, and for a few others these comprise the first published detailed records for Russia. For many species these records show an enormous eastward extension of the known distribution. The few records of species in the *Stigmella ruficapitella* group have also been given by van Nieukerken & Johansson (2003).

Material and methods

Adults were mainly collected at light, mostly using a small generator with different types of lamps, or by sweeping vegetation at dusk. Leafmines were picked in the field and dried immediately; all attempts to rear the larvae were unsuccessful.

All specimens were identified or checked by the senior author. The adults are in the collection of V. V. Zolotuhin, but duplicates are stored in the National Museum of Natural History Naturalis, Leiden (RMNH). The majority of dried leafmines is kept in RMNH, with a reference collection kept by V. V. Zolotuhin.

Genitalia preparations were made partly in glycerine, partly in Euparal, following conventional procedures. Photographs of genitalia and of leafmines were taken with a Zeiss AxioCam digital camera attached to a Zeiss Axioskop H (genitalia slides) or a Zeiss Stemi SV 11 under dark field illumination (leafmines), using Carl Zeiss AxioVision 3.0.6 software. All photographs of genitalia show specimens embedded in Euparal, prepared by the senior author, and are annotated with 'EvN' numbers.

The described distribution of Nepticulidae over European countries follows van Nieukerken (2004), unless otherwise stated. Plant names follow the Flora Europaea (Tutin et al. 1964–1993; Flora Europaea website 2004).

Identification of leafmines. Since leafmines are not the organism itself, but only a trace, some authors prefer not to use records which are based on leafmines only, partly stimulated by the presence of many misidentifications in literature. However, in many cases leafmines show good diagnostic characters, certainly in combination with hostplant identity. By omitting such data, one would loose valuable information on the distribution of species. However, the presence on the basis of leafmines alone needs to be treated with caution: for several hostplants it is clear that the mines are not always different enough to allow safe identification. This is especially the case with *Stigmella* mines on *Quercus* (see van Nieukerken & Johansson 2003), on rosaceous herbs, *Rosa*, *Rubus* and *Pyrus*. Also some mines on *Ulmus* can be problematic. We have not attempted to name such mines with any certainty, but list them at the end of the paper. Even for some of the named mines, we would prefer confirmation by reared adults. Species which we only record on the basis of leafmines, are marked with an asterisk (*) before the name.

Collection localities. Under each species we list the records alphabetically by province and a short locality name. The full details of the localities are given here, the bold printed locality name is used as short name throughout the paper. The localities are shown in the map (fig. 1). For the transliteration of the Cyrillic we follow the BSI system, the same as used by Times (2000). We give the province (oblast) and district (rayon) names in English as noun (e.g. 'Ul'yanovsk'), not in the Russian adjectival form (e.g. 'Ul'yanovskaya Oblast'), but we provide below Cyrillic names in the adjectival forms for all localities. For the collector names we use abbreviations, see below.

Astrakhan: [Астраханская область]

1. Akhtubinsk distr., 10 km NNE pgt N. Baskunchak, near lake Karasuk, 48°11'N, 46°54'E [Ахтубинск, Баскунчак, оз. Карасук]
2. Akhtubinsk distr., Bogdo Bolshaja, Surikovskaya b., 47°59'N, 46°48'E [Ахтубинск, Богдо, Суриковская б.]

Chelyabinsk: [Челябинская область]

3. S. Ural: Arkaim reserve, near Amurskiy village, 52°39'N, 59°34'E [Заповедник Аркаим, пос. Амурский] (see Nupponen et al. 2000)

Kalmyk Republic: [Республика Калмыкия]

4. Elista City Park, 46°19'N, 44°16'E [Элиста, городской парк]
5. Yashalta, 20 km SW, 160 km W Elista, oak forests, 46°20'N, 42°18'E [Яшалта]

Samara: [Самарская область]

6. Samarskaya Luka area, Zhiguli State Nature Reserve, Bakhilova Polyana, 53°24'N, 49°40'E [Жигулевский заповедник, Бахилова Поляна]
7. Samarskaya Luka area, Zhiguli State Nature Reserve, mixed forest on rocky slope, 53°25'N, 49°40'E [Жигулевский заповедник]

Saratov: [Саратовская област]

8. Saratov city, 51°34'N, 45°59'E [Саратов]

Ul'yanovsk: [Ульяновская область]

9. Aksakovo, Mayna distr., 60 km SWS Ul'yanovsk, 54°09'N, 47°31'E [с. Аксаково, Майнский район]
10. Akulovka, Nikolaevka distr., 150 km SWS Ul'yanovsk, limestone steppe, 53°06'N, 47°29'E [Акуловка, Николаевский р-н]
11. Arskoe outskirts, Ul'yanovsk distr., 15 km W of Ul'yanovsk, meadow near mixed forest, 54°16'N, 48°08'E [с. Арское, Ульяновский р-н]
12. Baryshskaya Sloboda, Surskoe distr., 85 km WNW Ul'yanovsk, 54°34'N, 46°48'E [Барышская Слобода, Сурский р-н]
13. Beketovka, Veshkayma distr., 100 km W Ul'yanovsk, Steppe, 54°06'N, 46°52'E [Бекетовка, Вешкаймский р-н]
14. Glotovka, Inza distr., 120 km W from Ul'yanovsk, humid mixed forest, 53°57'N, 46°43'E [Глотовка, Инзенский р-н]
15. Kalinovka, Radishchevo distr., ca. 150 km S of Ul'yanovsk, orchards, 52°58'N, 48°19'E [Калиновка, Радищевский р-н]
16. Karamzina outskirts, Ul'yanovsk distr., 10 km SWS Ul'yanovsk, mixed forest near by water, 54°14'N, 48°22'E [пос. Карамзина, Ульяновский р-н]
17. Kryazh (=Kryachok), Barysh distr., 53°47'N, 47°25'E [оз. Кряж, Барышский р-н]
18. Mar'evka, Novospasskoe distr., 120 km S Ul'yanovsk, grass steppe, 53°08'N, 48°09'E [с. Марьевка, Новоспасский р-н]
19. Ryabina railway station, Povolzhye, Radishchevo distr., 160 km S Ul'yanovsk, orchards and oak forest edge 52°53'N, 48°15'E [ж/д ст. Рябина, Радищевский р-н]
20. Shikovka, Povolzhye, Pavlovka distr., 200 km S Ul'yanovsk, 52°44'N, 47°27'E [с. Шиковка, Павловский р-н]
21. Srednikovo, Radishchevo distr., 140 km S Ul'yanovsk, steppe, 52°56'N, 48°06'E [Средниково, Радищевский р-н]
22. Staraya Mayna, Staraya Mayna distr., 10 km NE, 54°37'N, 49°05'E [р.п. Старая Майна, Старомайнский р-н]
23. Surulovka, Novospasskoe distr., steppe, 53°06'N, 47°46'E [Суруловка, Новоспасский р-н]
24. Tsemzavod outskirts, Sengiley distr., 20 km S Ul'yanovsk, mixed forest 54°02'N, 48°21'E [пос. Цемзавод, Сенгилеевский р-н]
25. Ul'yanovsk North, park Pobedy, 54°22'N, 48°25'E [Ульяновск, парк Победы]
26. Ul'yanovsk city, valley of Sviyaga river 54°18'N, 48°20'E [Ульяновск, пойма р. Свияги]
27. Ul'yanovsk, Vinnovka city park, 54°16'N, 48°20'E [Ульяновск, парк Винновская роща]
28. Tushna, Sengiley distr., ca 40 km S of Ul'yanovsk, mixed forest, 53°50'N, 48°22'E [р.п. Тушна Сенгилеевского р-на]
29. Vasil'evka, Novospasskoe distr., 130 km S Ul'yanovsk, 53°05'N, 48°07'E [Васильевка, Новоспасский р-н]

30. Vjazovka, Radishchevo distr., 160 km S Ul'yanovsk, 52°53'N, 48°26'E [Вязовка, Радищевский р-н]
31. Vjazovka, 6 km S, Radishchevo distr., 166 km S Ul'yanovsk, 52°51'N, 48°21'E [6 км Ю с. Вязовка, Радищевский р-н]
32. Yulovo, Inza distr., mixed forest, 53°58'N, 46°32'E [Юлово, Инзенский р-н]

Volgograd: [Волгоградская область]
33. Chapurnikovskaya balka, Krasnoarmeysk (= Sarepta) distr., 48°29'N, 44°30'E [Чапурниковская балка, Красноармейский р-н]
34. Krasnoarmeysk (= Sarepta), 48°31'N, 44°29'E [Красноармейск]
35. Tumak outskirts, Sredneakhtub distr., 48°39'N, 44°41'E [Тумак, Сред. Ахтуба]

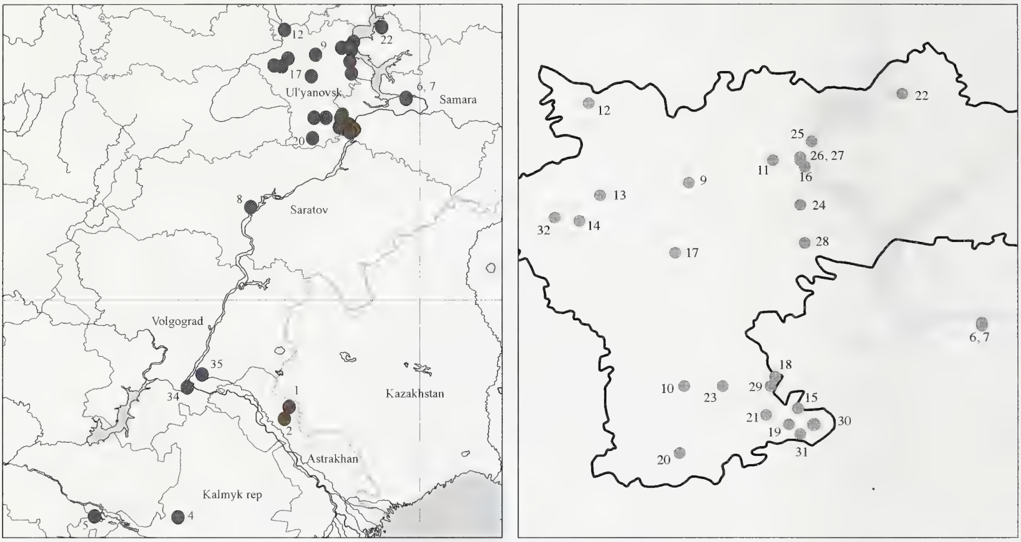


Fig. 1. Maps of the Volga region, showing the collection localities, see text for numbers; **Fig. 1.a.** Ul'yanovsk province.

Collectors. AV: V.V. Anikin. IA: A.Ju. Isajev. IV: V.B. Isajeva. JJ: J. Junnilainen. KD: D.A. Komarov. KA: A. Kovalev. MA: A.V. Mistchenko. NS: S.V. Nedoshivina. NK: K. Nupponen. RS: S.M. Rybakov. SS: S.A. Sachkov. SU: students of the Ul'yanovsk State pedagogical university. ZV: V.V. Zolotuhin.

Description of the region. The region is large and extends from the fringes of the Taiga in the north (ca. 54°20'N) to an extensive steppe zone in the southern parts (ca. 46°20'N). A more detailed description was given by Anikin et al. (1993). We describe a few localities were Nepticulidae were collected in more detail.

Parks in Ul'yanovsk City
Vinnovka forest-park and park Pobedy. – These are two very large forest-parks, which form recreation zones within the city. The Pobedy Park (fig. 2) consists of mixed forest remnants, with a dominance of *Betula pendula*, *Acer platanoides*, *Quercus*

Figs. 2–5. Some habitats where Nepticulidae were collected. **2.** Pobedy Park, Ul'yanovsk, in early spring, with flowering *Anemone*. **3.** Vinnovka park, Ul'yanovsk, with stream. **4.** Srednikovo, showing the grassy slopes and *Quercus robur* in foreground. **5.** Vjazovka: valley forest in background, steppe on foregound.

robur, *Populus tremula*, *Tilia cordata* and *Pinus sylvestris*. Smaller trees and shrubs are represented by *Sorbus aucuparia*, *Rhamnus cathartica*, *Euonymus verrucosus*, *Rosa* spp. and in open places the small shrubs *Chamaecytisus ruthenicus* and *Genista tinctoria*. The Vinnovka Park (fig. 3) is the remnant of a 19th century recreation area with orchards and forest. This park is situated in a deep ravine on the right banks of the Volga, with small sandy hills and numerous brooks. This condition results in an unusual mixture of xerophytic and hydrophytic plants. Most of the studied mines were collected in this park. The dominant trees are *Quercus robur*, *Alnus glutinosa*, *Acer platanoides*, *Tilia cordata*, *Corylus avellana*, *Ulmus* spp. and *Prunus spinosa*. Closer to the water grow different *Salix* spp., mainly *S. alba*, *S. triandra* and *S. caprea*. The open slopes in this park are completely covered with *Fragaria moschata, F. vesca* and other herbaceous Rosaceae. A rich fauna of Nepticulidae was found here, mostly as mines: *Stigmella naturnella*, *S. tiliae, S. aceris, S. malella, S. catharticella, S. paradoxa, S. salicis, S. lemniscella, S. lonicerarum, Ectoedemia atricollis, E. arcuatella, E. albifasciella, E. subbimaculella, E. spinosella* and all the *Populus* miners.

Forest biotopes

Aksakovo. – A small humid, deciduous forest within 2 km from the village, with a dominance of *Betula pubescens*, *B. pendula*, *Alnus glutinosa*, *Populus tremula* and *Salix* spp. There has only once been collected here, at light on 9 May, before budding of the trees. The collected Nepticulidae are the early flying species *Stigmella lapponica, S. magdalenae* and *S. sorbi*.

Forest-steppe biotopes

Srednikovo (fig. 4). – Mixed forest (*Pinus sylvestris*, *Populus tremula*, *Quercus robur*, *Prunus spinosa*, *Prunus fruticosa*, *Prunus padus*, *Rhamnus cathartica*) on limestone hills with a great diversity of rare plants on the open grassy slopes (*Hedysarum grandiflorum*, many species of *Astragalus*, *Globularia*, *Gypsophyla*, *Centaurea ruthenica*, *C. sumensis*, *Paeonia tenuifolia*). Here we collected the species feeding on *Chamaecytisus*: *Trifurcula pallidella* and *T. chamaecytisi*, but also *Stigmella glutinosae*.

Surulovka. – Similar vegetation, but on sandy steppe with a dominance of *Chamaecytisus*, *Genista*, *Fragaria* on open places. The Nepticulidae collected here, however, live on oaks: *Ectoedemia liebwerdella, E. longicaudella* and *E. albifasciella.*

Zhiguli. – The Zhiguli State nature Reserve is a hilly area (up to 382 m) on an Peninsula in a Volga Bend close to Samara, with ancient rocks of Permian age. These consist of dolomites and limestone covered with forests and small pockets with steppe. The dominant trees are *Quercus robur*, *Tilia cordata*, *Betula pendula*, *Pinus sylvestris*, *Acer platanoides*, *Populus tremula* with some *Ulmus glabra* and other *Acer* spp. and in the under storey *Lonicera xylosteum*, *L. tatarica*, *Viburnum opulus*, *Sambucus nigra*, *Rosa* spp., *Crataegus ambigua* (= *volgensis*), *Corylus avellana*, *Euonymus verrucosus* and *Rubus* spp. The shrubs *Caragana frutex* and *Spiraea crenata* are typical for the limestone steppes and *Caragana arborescens* grows in artificial plantations at lower altitudes. The herb flora is very rich, with a dominance of different Rosaceae, Poaceae, Fabaceae, as well as endemic and sub-endemic Caryophyllaceae and Ranunculaceae. Some leafminers of this reserve have previously been reported (Sachkov et al. 1997) and the Nepticulidae fauna is rich and comprises *S. naturnella*, *S. microtheriella*, *S. paradoxa*, *S. oxyacanthella*, *S. hybnerella*, *S. floslactella*, *S. trimaculella*, *S. lemniscella*, *S. lonicerarum*, *S. basiguttella*, *Trifurcula beirnei* and *Ectoedemia* (*Zimmermannia*) *liebwerdella.*

Steppe biotopes

Beketovka. – Sandy and limestone hills with a dominance of herbaceous Rosaceae and Fabaceae. The collecting site is situated in an *Elaeagnus* plantation near the water. Nepticulidae collected here are *Stigmella thuringiaca*, *S. aceris* and *Trifurcula silviae.*

Mar'evka. – A steppe on salty clay, with *Limonium* and various Asteraceae. One collecting locality is situated in the middle of the steppe under the only *Salix triandra/alba* trees on a bank of a stream with *Phragmitis australis*. The collected Nepticulidae feed on *Salix* and *Populus*: *Stigmella zelleriella, S. obliquella, S. trimaculella* and *Ectoedemia hannoverella* and thus were probably all collected near this stream.

Vjazovka and 6 km S Vjazovka (fig. 5). – These very interesting localities are situated on the right bank of Volga in the so-called 'bayrachnyj les', valley-forest with a dominance of *Acer tataricum*, *Quercus robur*, *Rhamnus cathartica*, *Euonymus verrucosus*, *Prunus spinosa* and some *Prunus tenella*, *Caragana frutescens*, *Sorbus* *aucuparia* and the vine *Aristolochia clematitis*. On the top of the slopes one finds a very hot clay- and salt-steppe, with a dominance of Chenopodiaceae (*Kochia*), a small shrubby *Artemisia* (*A. lerchiana*), *Atraphaxis spinosa*, *Ferula caspica*, *Allium* spp., *Tulipa* and some rare Fabaceae. In ravines grows a very rich vegetation with a dominance of mesophytic Fabaceae, *Fragaria*, *Peucedanum ruthenicum* and Poaceae. The Nepticulidae here are *Stigmella rolandi*, *S. hybnerella*, *S. plagicolella*, *S. roborella*, *S. samiatella* and *Ectoedemia liebwerdella*.

Volgograd area
Chapurnikovskaya balka. – This site has a very rich flora, with both forest and steppe vegetations. On the slopes of the gullies one finds a deciduous forest amidst the sub-zone of southern, desert-steppes. The dominant tree species are *Quercus robur*, *Ulmus* spp., *Alnus glutinosa*, *Salix* spp., *Populus nigra* and *P. tremula*. In addition there are plantations of *Pinus sylvestris*, *Robinia pseudoacacia* and *Caragana arborescens*. The steppe grassland is very rich, with a dominance of *Stipa* spp. and various other grasses, *Artemisia* spp., *Euphorbia* spp. and different Fabaceae. The nepticulid fauna comprises *Stigmella aceris*, *S. ulmiphaga*, *S. rolandi*, *S. obliquella*, *S. samiatella* and *Ectoedemia caradjai*.

Plantations in Kalmyk Republic. – The city park of Elista, and the oak forest SW of Yashalta are artificial plantations in a region of desert or semi-desert. There is no doubt that most or all species of Nepticulidae here on trees were introduced with their hosts, such as *Stigmella viscerella* and *Ectoedemia spinosella*.

SPECIES TREATMENTS

Stigmella naturnella (Klimesch, 1936) New for European Russia

Astigmella dissona Puplesis, 1984 **syn. nov.**

Material. Samara: 1♂, Zhiguli, Bakhilova Polyana, 14.v.1992, SS. – Ul'yanovsk: 13♂, Pobedy, 19.iv.1995, under trunks of birch (*Betula* sp.), IV; 80 mines, some with larvae, Ul'yanovsk, Vinnovka, *Betula*, 9, 21, 30.ix.2002, MA, SU.

Remarks. By study of the holotypes of *S. naturnella* and *S. dissona* it has become clear that they are actually one species. The characters mentioned by Puplesis (1994) do not hold when more material is concerned, see fig. 24–26 for the male genitalia. The leafmines (fig. 8–10) of this species are best recognized by the absence of most diagnostic characters of other *Betula* miners. They resemble a short mine of *S. confusella* (Wood & Walsingham, 1894), or *S. luteella*, but the latter usually feeds partly in underside parenchyma, resulting in a greenish mine, and starts with a short contorted part.

The finding of *S. naturnella* in this part of Russia bridges the enormous distributional gap between central Europe, where it has been found in Italy, Austria, Czech Republic, Slovakia, Hungary and Russia: Primory'e. We assume that it has a continuous distribution with its host *Betula* throughout Siberia. A similar distribution is assumed for other species feeding on birch, currently known from Europe and the Far East: *S. betulicola*, *S. luteella*, S. *sakhalinella* Puplesis, 1984, *S. continuella* and *Ectoedemia occultella*. Whereas *S. naturnella* is usually a rare species in central Europe, it seems here to be the commonest *Betula* miner.

Stigmella lapponica (Wocke, 1862)

Material. Ul'yanovsk: 1♂, Aksakovo, 9–10.v.1996, in forest, ZV; 1♀, Yulovo, 30.iv.1994, IV; 1 mine, Ul'yanovsk, *Betula*, 9.ix.2002, SU; 2 mines with larvae, Vinnovka, *Betula*, vii–viii.2002, MA.

Remarks. A widespread species feeding on *Betula*, previously known from northern Russia, Murmansk, Karelia and Leningrad (Jürivete et al. 2000; Kozlov & Jalava 1994; Kutenkova 1989) but expected to occur all over Russia. It has also been recorded from Siberia: Chita (Kulishenko 1987) and Novosibirsk (Puplesis 1994). Leafmines are characteristic (fig. 6), even more so than the adults, which may be confused with *S. confusella*.

* *Stigmella freyella* (Heyden, 1858) New for Russia

Material. Ul'yanovsk: 5 mines, Tsemzavod, *Calystegia sepium*, mid vii.2003, MA.

Remarks. *S. freyella* is widespread in the more southern half of Europe, including the Crimea, Ukraine (Gerasimov 1952) and goes north to the Netherlands, Germany, Poland and Latvia. The leafmines are characteristic (fig. 11) and cannot be confused with anything else.

* *Stigmella tiliae* (Frey, 1856)

Material. Ul'yanovsk: 3 mines, *Tilia*, Ul'yanovsk, 9.ix.2002, SU; 10 mines, Vinnovka, *Tilia cordata*, vii–viii.2002, MA.

Remarks. Previously recorded from Tatarstan (Krulikowsky 1908) (marked with a question mark), Samara (Sachkov et al. 1997) and Krasnodar (Puplesis 1994); also in all neighbouring states. *S. tiliae* occurs probably everywhere with *Tilia*.

* *Stigmella betulicola* (Stainton, 1856)

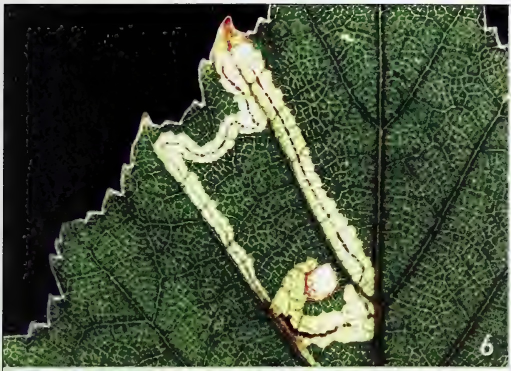
Material. Ul'yanovsk: 1 mine, Vinnovka, 21.ix.2002, MA.

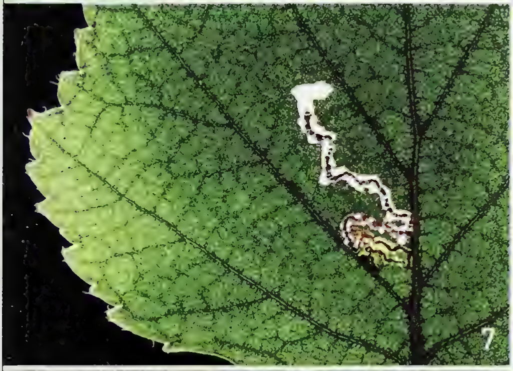
Remarks. A widespread species, occurring throughout Europe to the far north and also in Japan and China (Kemperman et al. 1985; Nieukerken & Liu 2000). In Russia recorded from Murmansk, Karelia, Leningrad, Smolensk, Samara and Tatarstan (Jürivete et al. 2000; Kozlov & Jalava 1994; Krulikowsky 1908; Kutenkova 1989; Sachkov et al. 1997; Skala 1944). The mines are usually well identifiable, but since we only got a single mine here, confirmation is required. It feeds on *Betula*, and often occurs gregariously (more mines on one leaf) on seedlings and saplings of birch.

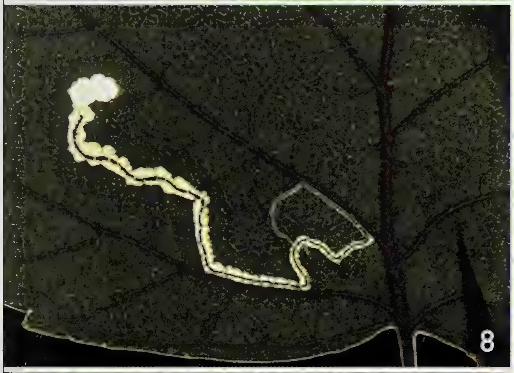
* *Stigmella nivenburgensis* (Preissecker, 1942) New for Russia

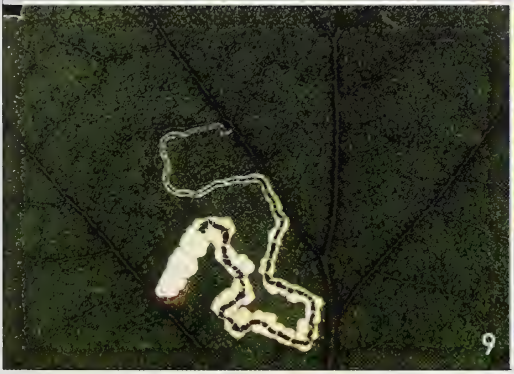
Material. Ul'yanovsk: 5 mines, Vinnovka, 21.ix.2002, *Salix cf triandra*, leg. MA.

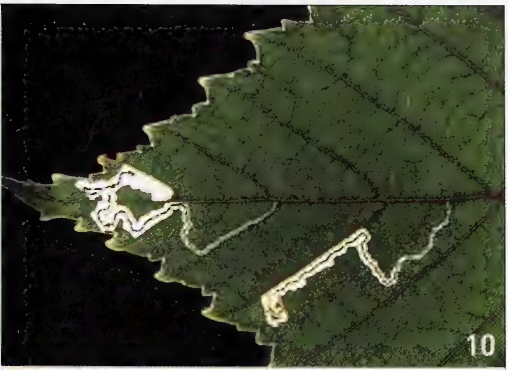
Remarks. *S. nivenburgensis* occurs scattered in Central and East Europe, closest in Lithuania and Poland, and is also reported from Turkmenistan (Puplesis 1994). It is the only species in the *S. betulicola* species group feeding on *Salix*. The mines are narrow and straight (fig. 14), very different from those of the *S. salicis* group.

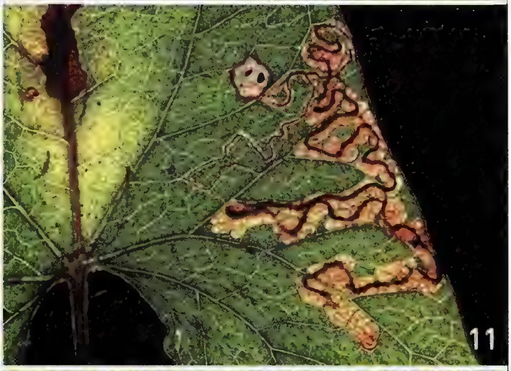


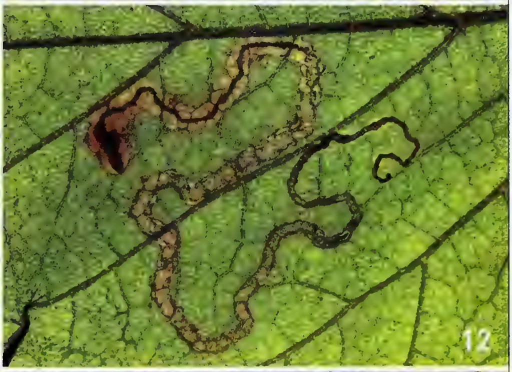


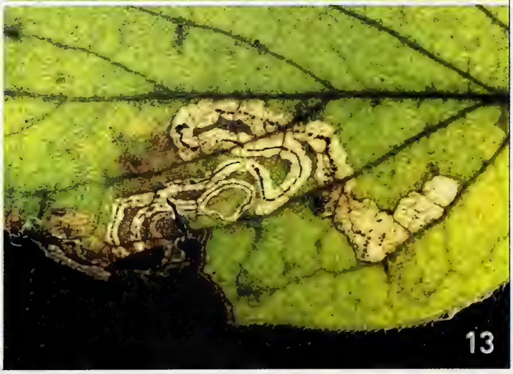












Figs. 6–13. Leafmines of *Stigmella* (all, except fig. 11, from Ul'yanovsk: Vinnovka). **6.** *S. lapponica* on *Betula*. **7.** *S. luteella* on *Betula*. **8–10.** *S. naturnella* on *Betula*. **11.** *S. freyella* on *Calystegia sepium* (Tsemzavod). **12.** *S. aceris* on *Acer tataricum*. **13.** *S. lonicerarum* on *Lonicera xylosteum*.

* *Stigmella luteella* (Stainton, 1857)

Material. Ul'yanovsk: 9 mines, Ul'yanovsk, Vinnovka, *Betula pendula*, 9–30.ix.2002, MA, SU.

Remarks. *S. luteella* is known from Karelia (Kutenkova 1989), and according to (Puplesis 1994) it occurs throughout Russia to Sakhalin. Leafmines are usually rather characteristic (fig. 7), being often partly in the lower mesenchym only, which makes the mine appear green from above. Some mines, however, may be difficult to separate from those of *S. betulicola* or *S. naturnella* (see above).

Stigmella glutinosae (Stainton, 1858) New for Russia

Material. Ul'yanovsk: 1♂, Srednikovo, 6.vi.1998, ZV (EvN3485); 4 mines, Vinnovka, 21.ix.2002, *Alnus glutinosa,* leg. MA (fig. 27).

Remarks. *S. glutinosae* is widespread throughout Europe and occurs in all neighbouring states, but no pertinent records for Russia could be found. Gerasimov (1952) recorded it from the northern and central parts of the European part of the Soviet Union, but the latter at that time also included the Baltic republics and the Ukraine, from where the species is also known. The leafmines can easily be confused with those of *S. alnetella* (Stainton, 1856), although the mines recorded here have the wider frass line which is more characteristic for *S. glutinosae*. However, on the basis of mines alone the species would not have been recorded.

Stigmella microtheriella (Stainton, 1854)

Material. Samara: 1♀, Samara, 8.vi.1998. – Ul'yanovsk: 1 mine, Vinnovka, 15.vii–15.viii.2001, MA; 4 mines, Ul'yanovsk, 9.ix.2002, SU; 4 mines, Vinnovka, vii–viii.2002, MA. All mines on *Corylus avellana*.

Remarks. *S. microtheriella* feeds on *Carpinus, Corylus* and *Ostrya*, and is the only known parthenogenetic *Stigmella*-species. It is widespread and abundant throughout Europe. Puplesis (1994) listed it as Russian, without detailed localities, and it has recently been cited from Zhiguli, Samara (Sachkov et al. 1997).

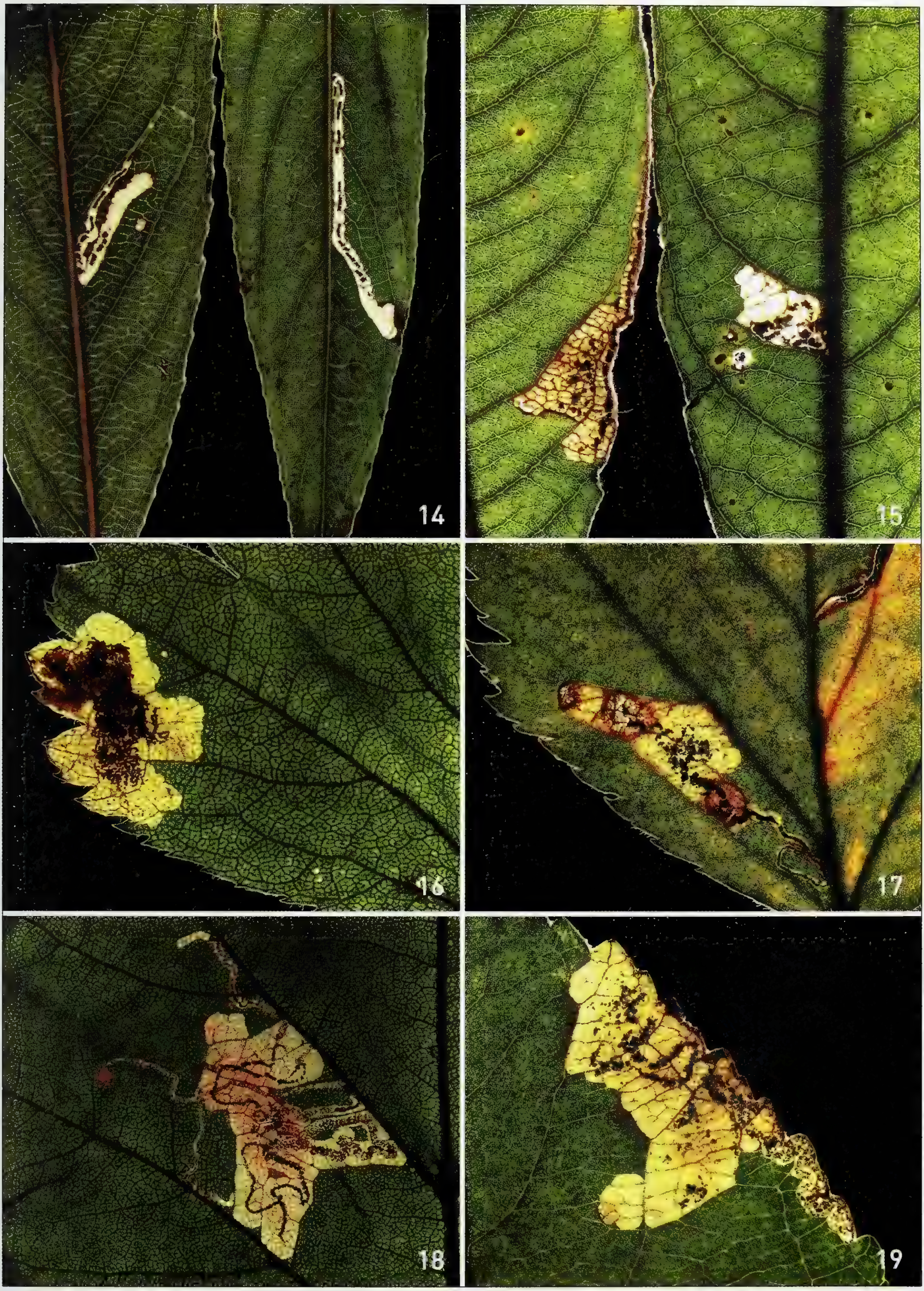
* *Stigmella prunetorum* (Stainton, 1855)

Material. Ul'yanovsk: 14 mines, Vinnovka, *Prunus domestica/P. spinosa*, 21.–30.ix.2002, MA; 7 mines, Vinnovka, *Prunus cerasus,* vii–viii.2002, MA.

Remarks. No detailed records from Russia have been published, although Puplesis (1994) records it from southern Russia. This record refers to adults from Belgorod (Borisovka) (R. Puplesiś, pers. comm.). The mines are very characteristic (fig. 20) and easy to separate from sympatric *S. plagicolella* and *Ectoedemia spinosella*.

Stigmella aceris (Frey, 1857)

Material. Ul'yanovsk: 1♂, Beketovka, 11.–13.vii.1998, Steppe, IV & IA; 2♂, 2♀, Pobeda 20.x.2002, under bark of Pinus, IA, KA; 4 mines, Ul'yanovsk city, *Acer platanoides*, 9.ix.2002, SU, 7 mines, Vinnovka, *Acer platanoides*, 15.vii.–15.viii.2001, vii.–viii.2002, MA; 18 mines, Vinnovka, *Acer tataricum,* vii.–viii.2002, MA. – Volgograd: 2 ♀, Chapurnikovskaya balka, 21.viii.1999, KD.



Figs. 14–19. Leafmines of *Stigmella* (all, except fig. 17, from Ul'yanovsk: Vinnovka). **14.** *S. nivenburgensis* on *Salix cf triandra*. **15.** *S. obliquella* on *Salix cf triandra*. **16.** *S. paradoxa* on *Crataegus* sp. **17.** *S. hybnerella* on *Crataegus ambigua* (Samara: Zhiguli). **18.** *S. perpygmaeella* on *Crataegus* sp. **19.** *E. atricollis* on *Malus domestica*.

Remarks. This species is common in Southern and Eastern Europe, feeding on *Acer campestre*, *A. platanoides* and *A. tataricum* (mines, fig. 12). From Russia previously recorded from 'southern Russia' (Puplesis 1994), which refers to Belgorod (1♂, 1♀ in ZIN: Borisovka, 1985, leg. Krivochatskij), and recently from Samara (Sachkov et al. 1997). Male and female genitalia are illustrated in figs. 28 and 47. The finding of adults as late as 20 October, under the bark of *Pinus*, indicates the possibility of hibernating adults, which was hitherto an unknown phenomenon in European Nepticulidae. However, they also may just be surviving stragglers from the summer generation.

* *Stigmella malella* (Stainton, 1854)

Material. Ul'yanovsk: 4 mines, Arbuzovka, 30.viii.2002, ZV; 15 mines, Ul'yanovsk city, 9.ix.2002, SU; 54 mines, Ul'yanovsk, Vinnovka, 9.–30.ix.2002, MA, SU. All on *Malus domestica*.

Remarks. This common pest of apple (*Malus*) has been reported from Stavropol, southern Ural (Puplesis 1994) and Krasnodar (Kozlov & Koricheva 1989, 1991). Chagelishvili (1972) reports it as a pest in Georgia, from Russia we do not know any report as pest. Leafmines may be confused with those of *S. desperatella*, which has green larvae in contrast to the yellow ones in *S. malella*. *S. desperatella* is not yet known from Russia, but appears to be common in the Caucasus (Puplesis 1994). Because of this the Georgian records need to be viewed with caution (R. Puplesis, pers. comm.).

* *Stigmella catharticella* (Stainton, 1853)

Material. Ul'yanovsk: 5 mines, Vinnovka, *Rhamnus cathartica*, 15.vii.–15.viii.2001; 2 mines, 21.–30.ix.2002, MA.

Remarks. A widespread European species, previously recorded from Russia without detail (eastern Europe, including southern Ural (Puplesis 1994). The mines are very characteristic and cannot be confused with those of the Central European *S. rhamnella* (Herrich-Schäffer, 1860), which feeds on the same host.

* *Stigmella viscerella* (Stainton, 1853)

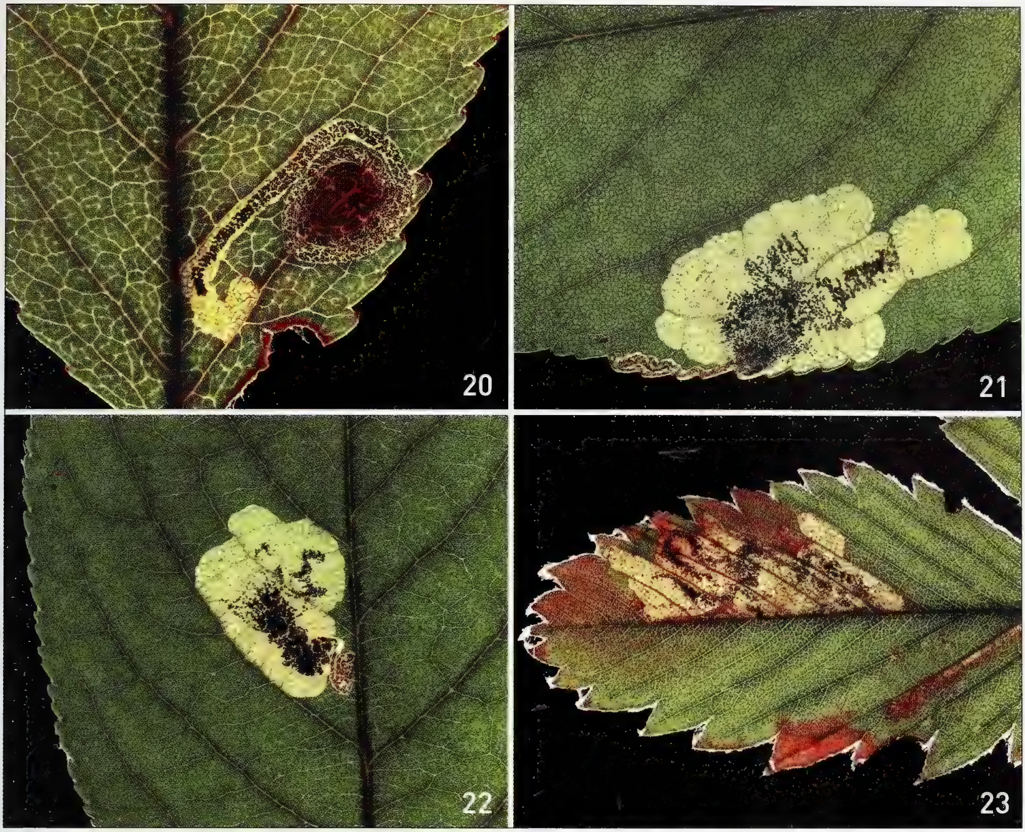
Material. Kalmyk Republic: mines, Ulmus sp., Elista, 26.ix.2000, ZV.

Remarks. A widespread European species, particularly in southern Europe. There is only one previous Russian record, of leafmines from Samara (Sachkov et al. 1997). The mines are very characteristic, but occasionally individual mines of *S. lemniscella* may resemble those of *viscerella*. However, in this case the large sample of similar mines and the absence of 'normal' *S. lemniscella* mines indicate that they are indeed *viscerella*.

Stigmella ulmiphaga (Preissecker, 1942) New for Russia

Material. Astrakhan: 1 ♂, Karasuk, 31.v.1999, KD. – Volgograd: 1 ♂, Chapurnikovskaya balka, 21.viii.1999, KD (fig. 29).

Remarks. *Stigmella ulmiphaga* occurs scattered in South-East Europe from Austria to Greece, and is also known from Turkmenistan, where it is common (Puplesis 1994) and sometimes abundant (R. Puplesis pers. comm.).



Figs. 20–23. Leafmines of Nepticulidae (all from Ul'yanovsk: Vinnovka). **20.** *Stigmella prunetorum* on *Prunus spinosa*. **21–22.** *Ectoedemia spinosella* on *Prunus sp*. **23.** *E. arcuatella* on *Fragaria moschata*.

Unidentified mines on *Ulmus* from Elisha and Ul'yanovsk could either belong to this species, to *S. ulmivora* (Fologne, 1860) or to *S. kazakhstanica* Puplesis, 1991, which all make very similar mines. Sachkov (1996) recorded *S. ulmivora* from Samara, but these mines could also belong to *S. ulmiphaga*, although we think that the occurrence of *S. ulmivora* in the mesophytic forests of Samara and Ul'yanovsk is very likely.

Stigmella kazakhstanica Puplesis, 1991

Remarks. Previously reported on the basis of empty mines in Astrakhan (Puplesis et al. 1991), and is further known from nearby Kazakhstan and Turkmenistan (Diškus & Puplesis 2003). These mines actually could also have belonged to *S. ulmiphaga*, which makes similar mines.

Stigmella thuringiaca (Petry, 1904) New for Russia

Material. Ul'yanovsk: 5♂, Beketovka, 11.–13.vii.1998, steppe, IV & IA; 2♂, Vasil'evka, 9.–10.vi.1998, 17.–19.vii.1999, IA & IV.

Remarks. *S. thuringiaca* has a wide distribution in Southern and Central Europe, from Spain in the West, to Germany and Poland in the North. The nearest previously known occurrence was in the Crimea, Ukraine (Puplesis 1994). The larva feeds on a number of herbaceous Rosaceae, such as *Potentilla* spp., *Fragaria* spp., *Sanguisorba minor, Agrimonia* and *Filipendula* spp., often on dry grassland biotopes. The steppe habitat in this area fits this picture. Mines are difficult to separate from other Rosaceae feeders: on *Potentilla* they can be confused with *S. tormentillella* (Herrich-Schäffer, 1860), on *Filipendula* with *S. filipendulae* (Wocke, 1871), and on *Sanguisorba* with *S. poterii* (Stainton, 1857), *S. rolandi*, *S. anomalella* (Goeze, 1783) and *S. centifoliella* (Zeller, 1848).

Stigmella rolandi Van Nieukerken, 1990 New for Russia

Material. Ul'yanovsk: 3♂, Vjazovka 6 km S, 5.–6.viii.1998, ZV. – Volgograd: 1♂, 2♀, Chapurnikovskaya balka, 21.viii.1999, KD (figs. 30–31).

Remarks. *S. rolandi* is widespread in southern Europe, north to Germany and east to Ukraine, and also in the Tyan Shan mountains in Kazakhstan (Puplesis et al. 1992). It feeds on *Rosa* and *Sanguisorba*.

* *Stigmella paradoxa* (Frey, 1858) New for Russia

Stigmella juryi Puplesis, 1991: 125. **syn. nov.**

Material. Samara: 3 mines, Zhiguli, *Crataegus ambigua*, 5.x.2003, ZV. – Ul'yanovsk: 9 mines, Vinnovka, *Crataegus* sp., vii.–viii.2002, MA.

Remarks. *Stigmella juryi* was described from the Crimea and Turkmenistan on the basis of adults collected at light. Later A. Diškus discovered that *S. juryi* makes similar mines on *Crataegus* as *S. paradoxa* (R. Puplesis & A. Diškus, pers. comm.). By comparing a series of Western European *S. paradoxa* and paratypes of *S. juryi* (in RMNH), it appeared that the difference given by Puplesis (1991), large anterior processes of gnathos in *S. juryi* does not hold: these processes are similar in many specimens of *S. paradoxa*, and are variable as well; moreover, also the way of mounting the genitalia influences the appearance of these processes. On suggestion of R. Puplesis (in litt.) we therefore synonymise *S. juryi* here.

Although *S. paradoxa* is widespread in Europe, it is usually one of the rarer species feeding on *Crataegus*. It has not been recorded from Russia before, the closest occurrence is in Ukraine (Crimea) and Moldova; it also occurs commonly in Turkmenistan (paratypes of *S. juryi*), and recently it has also been recorded from Iran (Laštůvka & Huemer 2002). The mines are unmistakeable (fig. 16), the rather similar mines of *Leucoptera malifoliella* (O.-G. Costa, 1836) differ by the concentric circles of frass and by the shape of the egg-scale which is a rounded cap-like structure in Nepticulidae, but has a flat surface and vertical sides in *Leucoptera*.

Stigmella magdalenae (Klimesch, 1950)

Material. Ul'yanovsk: 11♂, 8♀, Aksakovo, 9.–10.v.1996, ZV; 6 mines, *Sorbus aucuparia*, 10 km NE Staraya Mayna, 15.vi.–1.vii.2001, MA; many mines, Tushna, *Sorbus aucuparia*, 1.ix.2002, leg. ZV; 9 mines, Vinnovka, *Sorbus aucuparia*, vii.–viii. 2002, MA.

Remarks. This species is particularly common in northern parts of Europe, but more to the south confined to the mountains. In Russia it was known from Leningrad

(Kozlov 1996). *Sorbus aucuparia* is the best known host, but it also occurs on other *Sorbus* spp., *Cotoneaster, Malus* and *Amelanchier* (Johansson & Nielsen 1990). Leafmines can usually be separated from those of *S. nylandriella* by the much smaller size and the usually narrower frass. Also, mines of *S. magdalenae* often occupy only a small portion of the leaflet, whereas those of *S. nylandriella* usually run throughout a leaflet.

* *Stigmella nylandriella* (Tengstrôm, 1848)

Material. Ul'yanovsk: 1 mine, *Sorbus aucuparia*, Staraya Mayna, 15.vi.–1.vii.2001, MA; 4 mines, Tushna, *Sorbus aucuparia*, 1.ix.2002, ZV.

Remarks. *S. nylandriella* is widespread in Europe on *Sorbus aucuparia*, with a wider distribution than *S. magdalenae*. In Russia it has been recorded from Bryansk, Murmansk, Karelia, Leningrad and Voronezh (Jürivete et al. 2000; Kozlov 1996; Kozlov & Koricheva 1990, 1991; Kozlov & Jalava 1994; Kutenkova 1989; Skala 1944), although it is possible that some of these records are misidentifications of *S. magdalenae*. The mines recorded here look like a normal *S. nylandriella* mine, so most likely belong indeed to this species. However, confirmation by adults would be welcome.

* *Stigmella oxyacanthella* (Stainton, 1854)

Material. Samara: 1 mines, Zhiguli, *Malus*, 5.x.2003, ZV. – Ul'yanovsk: 2 mines, Vinnovka, *Pyrus communis*, 21.ix.2002, MA.

Remarks. *S. oxyacanthella* is a widespread European species, feeding on a number of Rosaceous trees. Mines are usually easy to recognize, but there is some doubt for those on *Pyrus*, where several rather similar species occur (see below). The mine on *Malus* almost certainly is *S. oxyacanthella*, but a reared adult is still needed for a final confirmation. In Russia it was hitherto only recorded from Leningrad (Kozlov 1996).

Stigmella hybnerella (Hübner, 1813) New for Russia

Material. Samara: 5 mines, Zhiguli, *Crataegus ambigua*, 5.x.2003, ZV. – Ul'yanovsk: 1♀, Vjazovka, 6 km S, 5.–6.viii.1998, steppe, ZV [gen. lost]

Remarks. *Stigmella hybnerella* is a very common and widespread *Crataegus* feeding species, occurring from Europe eastwards to Turkmenistan. It is therefore surprising that no previous records for Russia exist. Puplesis (1994) reports the species from the Baltic States, Ukraine, Azerbaijan and Turkmenistan. The mine is easily recognizable (fig. 17).

* *Stigmella floslactella* (Haworth, 1828)

Material. Samara: 4 mines, Zhiguli, 5.x.2003, ZV. – Ul'yanovsk: 4 mines, Vinnovka, *Corylus avellana*, vii.–viii.2002, MA.

Remarks. A widespread European species, previously recorded as leafmines from Bryansk (Skala 1944) and Samara (Sachkov et al. 1997). The mines are separated from those of *S. microtheriella* by the larger size, the more sinuous course and the wide frass. With larvae it is even easier: those of *floslactella* feed with the dorsum upwards, and have a dark headcapsule and prothoracic plate, whereas *S. microtheriella* feeds with venter upwards and has a pale head and prothorax.

* *Stigmella salicis* (Stainton, 1854)

Material. Ul'yanovsk: 16 mines, pos. Karamzina, *Salix caprea*, mid vii.2003, MA; 4 mines, Vinnovka, *Salix caprea* and *Salix* sp., vii.–viii.2002, MA.

Remarks. This is one of the most widespread and commonest Nepticulidae in Europe, in Russia known from Smolensk, Karelia, Murmansk and Samara (Kozlov & Jalava 1994; Kutenkova 1989; Sachkov et al. 1997; Skala 1944). The earlier report from the Tyan-Shan is incorrect: these specimens have later been described as *Stigmella johanssoni* Puplesis & Diškus, 1996 (Puplesis 1994; Puplesis & Diškus 1996). *S. salicis* feeds on the 'sallow-type' of *Salix*: *S. caprea, S. cinerea* and *S. aurita* and a few others. However, it is possible that *S. vimineticola* (Frey, 1856) has a wider host-range and distribution than previously thought (see Aarvik et al. 2001), so that there is a slight possibility that leafmines could be confused.

Stigmella zelleriella (Snellen, 1875)

Material. Ul'yanovsk: 3♂, Mar'evka, 20.–23.vii.1999, IA & IV.

Remarks. *S. zelleriella* occurs in coastal dunes along the North Sea and the Baltic Sea on *Salix repens*, and on the other hand in northern Europe in mountain tundra on *Salix lapponum* (Johansson & Nielsen 1990). In Russia one specimen has been recorded from Murmansk: Kola Peninsula, in a peat bog (Kozlov & Jalava 1994), close to its occurrence in Fennoscandia, and it is also recorded from Leningrad (Jürivete et al. 2000), probably along the Baltic Sea. The present record is far apart from any previous one, suggesting its more widespread occurrence in Russia. This locality is actually rather atypical, in a river-valley forest with tall *Salix* species (most likely *S. triandra*) and without any of the known hosts. We assume therefore that *S. zelleriella* feeds here on *S. triandra*, a previously unknown host.

Stigmella obliquella (Heinemann, 1862) New for European Russia

Material. Ul'yanovsk: 3♂, 2♀, Mar'evka, 21.–23.vii.1999, Steppe, IA & IV; 1♂, 1♀, Vasil'evka, 9.–10.vi.1998, ZV; 1 mine, *Salix* cf. *triandra*, Vinnovka, 21.ix.2002, MA; 22 mines, Vinnovka, narrow-leaved *Salix*, vii.–viii.2002; 7 mines, Sviyaga, mid vii.2003, MA. – Volgograd: 1 ♂, Chapurnikovskaya balka, 21.viii.1999, KD.

Remarks. This species is widespread in Europe, feeding on narrow leaved *Salix*-species, such as *Salix alba*, and is also found in eastern Asia, Primory'e (Puplesis & Diškus 2003) and China (Van Nieukerken unpublished). There are no previously published records from the European part of Russia (Puplesis 1994: probably in western part of Russia), but the senior author observed mines, most likely of this species, in St. Petersburg (Vasiljevskiy Ostrov), 19.x.1985, on *Salix fragilis*. The records here show that it is common in the Volga valley from north to south. Because *S. zelleriella* now appears also to be able to feed on the same narrow-leaved *Salix* species, there is still some doubt about the identification of the leafmines (fig. 15). Male genitalia are illustrated in fig. 34.

Stigmella trimaculella (Haworth, 1828)

Material. Samara: 1 mine, Zhiguli, *Populus nigra*, 5.x.2003, ZV. – Ul'yanovsk: 1♀, Mar'evka, 21.–23.vii.1999, IA & IV; many mines, Vinnovka, *Populus nigra* and *balsamifera*, 15.vii.–15.viii.2001, vii.–21.ix.2002, MA.

Remarks. This widespread *Populus*-miner was previously recorded from Tatarstan (Krulikowsky 1908), southern Ural (Puplesis 1994) and mines from the North Ossetian ASSR (Utech 1962). It occurs also in the Leningrad region and Siberia: Novosibirsk (R. Puplesis, pers. comm.).

* *Stigmella assimilella* (Zeller, 1848)

Material. Ul'yanovsk: 1 mine, Kalinovka, end viii.2002, RS; 2 mines, Vinnovka, vii.–viii.2002, MA; 1 mine, Sviyaga, mid-vii.2003, MA, all on *Populus tremula*.

Remarks. *S. assimilella* is nowhere very common, but widespread with its host *Populus tremula*, and in Russia previously reported from Samara and Kaluga (Sachkov et al. 1997; Shmytova 2002) and also extends to the southern Ural and Primorskiy Kray (Puplesis 1994).

Stigmella sorbi (Stainton, 1861)

Material. Ul'yanovsk: 1♀, Yulovo, 1994, IV; 2♂, Aksakovo, 9.–10.v.1996, ZV; 1♂, 1♀, Ul'yanovsk region without exact data, summer 2001, IV; 3 mines, *Malus domestica*, Vinnovka, 2001, MA; 29 mines (some with larvae), Vinnovka, *Sorbus aucuparia*, vii.–viii.2002, MA.

Remarks. A very common boreal species, previously cited from Murmansk, Karelia, Leningrad, Kaluga and Tatarstan (Kozlov 1996; Kozlov & Koricheva 1991; Kozlov & Jalava 1994; Krulikowsky 1908; Kutenkova 1989; Shmytova 2001, 2002), and also known from Siberia: Chita (Kulishenko 1987). Common on mountain ash (*Sorbus aucuparia*), but also on *Malus, Cotoneaster* and sometimes other Rosaceae.

Stigmella plagicolella (Stainton, 1854)

Material. Kalmyk Republic: 3 mines, *Prunus spinosa* and *P. domestica*, Elista, 26.ix.2000, ZV. – Ul'yanovsk: 1♀, Vjazovka, 15.–16.vii.1999, IA & IV; 4 mines, Ul'yanovsk, *Prunus spinosa*, 9.ix.2002 SU; 8 mines, Vinnovka, *Prunus* sp., vii.–viii, 21.ix.2002, MA.

Remarks. This very widespread and common European species was previously recorded from Leningrad (Jürivete et al. 2000) and also occurs in the Caucasus (Puplesis 1994).

* *Stigmella lemniscella* (Zeller, 1839)

Material. Samara: 2 mines, Zhiguli, 5.x.2003, ZV. – Ul'yanovsk: 1 mines, Ul'yanovsk, *Ulmus*, 9.ix.2002 SU; 27 mines, Vinnovka, *Ulmus*, vii.–viii.2002, MA.

Remarks. Widespread throughout Europe. Previously reported from mines in Bryansk (Skala 1944), and Samara (Sachkov et al. 1997); according to Puplesis (1994) also in southern Russia, referring to material from Belgorod (Borisovka, 2 ♂, viii.1985, Krivochatskij, ZIN).

* *Stigmella continuella* (Stainton, 1856)

Material. Ul'yanovsk: 1 mine, *Betula*, Vinnovka, 21.ix.2002, MA.

Remarks. A widespread but usually rare species on *Betula*, previously only cited from Karelia (Kutenkova 1989) and Primorskiy Kray (Puplesis 1994). Mines very characteristic.

Stigmella aeneofasciella (Herrich-Schäffer, 1855)

Material. Ul'yanovsk: 1♀, Ryabina, 31.v.1993, ZV; 5 mines, Arskoe, *Agrimonia eupatoria*, 20.viii.2003, MA; 5 mines, Vinnovka, *A. eupatoria*, vii.–viii.2002, MA.

Remarks. Known from Karelia and Murmansk (Kozlov & Jalava 1994; Kutenkova 1986). *Stigmella aeneofasciella* is widespread in Europe, and also known from most neighbouring countries. It is most commonly found on *Agrimonia*, but can also be found on *Potentilla* and *Fragaria*.

* *Stigmella perpygmaeella* (Doubleday, 1859) New for Russia

Material. Ul'yanovsk: 2 mines, Vinnovka, *Crataegus* sp., vii.–viii.2002, MA.

Remarks. This widespread *Crataegus* miner has not previously been recorded from Russia, although it is common in the neighbouring countries. Mines (fig. 18) can usually be identified, but confusion with *S. crataegella* (Klimesch, 1936) is still possible. Confirmation by adults is therefore needed.

* *Stigmella incognitella* (Herrich-Schäffer, 1855)

Material. Ul'yanovsk: 1 mine, Kalinovka, *Malus*, late viii.2002, RS.

Remarks. *S. incognitella* is widespread, but overall rarer than *S. malella* on the same host. Previously only recorded from Leningrad (Jürivete et al. 2000).

* *Stigmella lonicerarum* (Frey, 1856)

Material. Ul'yanovsk: 4 mines, Vinnovka, *Lonicera xylosteum*, 30.ix.2002, MA.

Remarks. *S. lonicerarum* occurs in most Central European countries, and goes northwards to Sweden, Finland and Estonia. There is one previous record from Russia and the Volga region, also based on leafmines: Samara, Zhiguli reserve (Sachkov et al. 1997). Leafmines (fig. 13) are easy to separate from the common Agromyzidae mines on the same host.

* *Stigmella basiguttella* (Heinemann, 1862)

Material. Kalmyk Republic: 2 mines, *Quercus robur*, Yashalta, 25.ix.2000, ZV. – Samara: 2 mines, Zhiguli, *Quercus robur*, 5.x.2003, ZV. – Ul'yanovsk: 3 mines, Vinnovka, *Quercus robur*, vii.–viii+21.ix.2002, MA.

Remarks. Previously reported from Smolensk, Belgorod, the Kalmyk republic (van Nieukerken & Johansson 2003; Skala 1944), and Samara (Sachkov et al. 1997). The Ul'yanovsk records appear on the map in van Nieukerken & Johansson (2003), but were inadvertently not listed in the material. This is the only European *Quercus* mining *Stigmella* species of which mines can be identified with certainty.

Stigmella samiatella (Zeller, 1839)

Material. Ul'yanovsk: 1♂, Shikovka, 20.vii.1993, ZV; 1♂, Vjazovka, 6 km S, 29.v.–3.vi.2000, ZV. – Volgograd: 2♀, Chapurnikovskaya balka, 25.vii + 21.viii.1999, KD; 1 ♂, Tumak, 22.vii.1997, KD.

Remarks. Apart from these provinces also recorded from Belgorod and Kaluga (van Nieukerken & Johansson 2003; Shmytova 2001, 2002).

Stigmella roborella (Johansson, 1971)

Material. Ul'yanovsk: 1♂, Vjazovka, 15.–16.vii.1999, IA & IV

Remarks. Only known in Russia from Ul'yanovsk and Kaliningrad (van Nieukerken & Johansson 2003; Puplesis 1994). Leafmines can not be identified with certainty. Some mines collected in Kalmyk Republic, Elista, could belong to this species, but other species are still possible.

Trifurcula (_Trifurcula_) _puplesisi_ Van Nieukerken, 1990

Remarks. One male from Sarepta (Volgograd) collected by Christoph was attributed with some doubt to this species (van Nieukerken 1990). We did not find it again.

Trifurcula (_Trifurcula_) _subnitidella_ (Duponchel, 1843) New for Russia

Material. Cheliabinsk: 1♀, Arkaim 9.vii.1997, NK & JJ (coll. Junnilainen).

Remarks. Widespread throughout Europe, previously recorded from Ukraine (Crimea) and Estonia (van Nieukerken 1990, 2004). The record in the Urals extends the distribution far to the East. The hostplant, *Lotus*, in which it makes stem-mines, is widely distributed all over Russia. The single female (fig. 48) corresponds well in all details with material from Western Europe.

Trifurcula (_Trifurcula_) _silviae_ Van Nieukerken, 1990 New for Russia

Material. Ul'yanovsk: 2♂, Beketovka, 11.–13.vii.1998, IV & IA (fig. 35).

Remarks. *T. silviae* was originally described from a number of localities in the French Alps, but later also found in very disjunct localities in Spain and Latvia (van Nieukerken et al. 1996). Recently it was also found in Austria and the Czech republic (Liška et al. 2002, A. & Z. Laštůvka, pers. comm.). In Latvia the species was reared from *Onobrychis arenaria*, a plant also known from the Ul'yanovsk area. The present record sheds another light on the isolation of the Latvian occurrence: it is not unlikely that *T. silviae* actually is rather widespread on steppe habitats in Eastern Europe, of which the Latvian is a northernmost, albeit rather isolated, example.

Trifurcula (_Trifurcula_) _beirnei_ Puplesis, 1984 New for Russia

Material. Samara: 1♀, Zhiguli, Bakhilova Polyana, 22.viii.1996, S. Sachkov (fig. 49).

Remarks. *T. beirnei* is known from a relatively small number of records from southern England, Denmark, Germany, Austria, Poland, Czech Republic, Slovakia and Hungary (Laštůvka & Laštůvka 1997; van Nieukerken 1996, 2004; van Nieukerken &

Johansson 1986). Although larvae are unknown, the species seems to be associated with *Genista*-species: *G. tinctoria, G. germanica* and *G. pilosa*. Of these, *Genista tinctoria* is common in the Volga area.

***Trifurcula* (*Trifurcula*) *pallidella* (Duponchel, 1843)**

Material. Ul'yanovsk: 1♂, Srednikovo, 19.vi.1994, ZV (figs. 39–40).

Remarks. *T. pallidella* is known from Central and Southeastern Europe. In Russia previously recorded from Saratov (Puplesis 1994) and also known from western Ukraine. The caterpillars make spindle shaped galls in stems of *Chamaecytisus* species (in some modern works regarded as *Cytisus* section *Tubocytisus*) and *Lembotropis* (Laštůvka & Laštůvka 1997). In the Ul'yanovsk region the only species of this group is *Chamaecytisus ruthenicus*, which we assume to be the host.

***Trifurcula* (*Trifurcula*) *chamaecytisi* Z. & A. Laštůvka, 1994** New for Russia

Material. Cheliabinsk: 1♂, Arkaim, 8.vii.1997, NK & JJ (coll. Junnilainen). – Ul'yanovsk: 2♂, Srednikovo, 10.–20.vii.1996, ZV; 2♂, same locality, 8.vi.1998, ZV; 1♂, Krjazh, 4.–10.vii.1998, IA & IV.

Remarks. *T. chamaecytisi* was only recently recognized as a species different from the very similar *T. immundella* (Zeller, 1839) (Laštůvka & Laštůvka 1994) and is known from Central eastern Europe (Austria, Czech and Slovak republics, Hungary), associated with various species of *Chamaecytisus*. The extension to the Volga and Ural regions conforms well with the distribution of this group of brooms, mapped together as '*Cytisus hirsutus*' (Sokolov et al. 1986), but usually considered as a group of species, of which *Chamaecytisus ruthenicus* occurs in the Ul'yanovsk region and in Arkaim (J. Junnilainen pers. comm.). Other *Trifurcula* species from the *immundella* species complex are not expected to occur in Russia, because the hosts are absent. For male genitalia see figs. 36–38.

*** *Bohemannia pulverosella* (Stainton, 1849)**

Material. Ul'yanovsk: 1 mine, Ul'yanovsk, *Malus*, 9.ix.2002 SU; 3 mines, Vinnovka, *Malus*, vii.–viii.2002, MA.

Remarks. Known from Leningrad (Puplesis 1994). Widespread throughout Europe. The mine may resemble that of *Ectoedemia atricollis*, see Van Nieukerken & Johansson (1990) for differences. *B. pulverosella* has usually ended feeding by mid-August, whereas *E. atricollis* larvae are usually not found before late August. The mine cited here from September was clearly an old mine.

*** *Ectoedemia* (*Etainia*) *sericopeza* (Zeller, 1839)**

Material. Ul'yanovsk: 3 mines in fruits of *Acer platanoides*, Vinnovka, 15.vii.–15.viii.2001, MA.

Remarks. *E.* (*E.*) *sericopeza* is a widespread species, the commonest of the subgenus, and has also been introduced in North America. In Russia it was known from Kaluga (Shmytova 2002) and Leningrad (Jürivete et al. 2000; Puplesis 1994). It feeds in the fruits of *Acer platanoides*, and the winter generation feed in shoots, petioles and buds.

* *Ectoedemia* (*Fomoria*) *weaveri* (Stainton, 1855)

Material. Ul'yanovsk: 3 mines with young larvae, Glotovka, *Vaccinium vitis-idaea*, 6.x.2002, NS.

Remarks. *Ectoedemia* (*Fomoria*) *weaveri* is a boreal species with a transpalaearctic distribution. It was previously cited from Murmansk in European Russia (Kozlov & Jalava 1994), and it occurs throughout to the Baikal, Chita and Yakutia regions in eastern Siberia (Bidzilya et al. 1998; Puplesis 1994). To this we can add Magadan even farther east and north in Siberia (Magadan, Upper Kolyna r., 500–1250m, 62°N – 149°40E, vii.1987, K. Mikkola, 7♂, Zoological Museum in Helsinki). Recently it was also recorded from Japan, Hokkaido (Kumata & Nakatani 1995).
E. weaveri feeds only on *Vaccinium vitis-idaea*, throughout winter, in the northernmost part of its distribution often during two years (van Nieukerken & Johansson 1990).

Ectoedemia (*Zimmermannia*) *liebwerdella* Zimmermann, 1940 New for Russia

Material. Samara: 1♂, Zhiguli, Bakhilova Polyana, 6.vii.1995, SS. – Ul'yanovsk: 2♂, Surulovka, 1.–3.vii.1997, IA & IV; 1♂, 6 km S Vjazovka, 5.–6.viii.1998, ZV.

Remarks. *Ectoedemia liebwerdella* occurs locally in Central and Southern Europe. It was originally described as a barkminer of *Fagus*, but many specimens have since been found in *Quercus* forests far away from *Fagus*, as is the situation here. These specimens we cannot separate from typical *E. liebwerdella*, although they usually are smaller. They differ from the closely related *E. atrifrontella* (Stainton, 1851) by the dark thorax and the larger humeral lobe and hairpencil of the hindwing. Male genitalia see figs. 41–42.

Ectoedemia (*Zimmermannia*) *longicaudella* Klimesch, 1953

Material. Ul'yanovsk: 2♂, Akulovka, 24.vii.1999, IA & IV; 1♂, Surulovka, 1.–3.vii.1997, IA & IV; 1♂, Vasil'evka, 17.–19.vii.1999, IA & IV

Remarks. *Ectoedemia longicaudella* is another barkminer of *Quercus*, and of the three European species it is the commonest and most widespread. It was known from Belgorod (Puplesis 1994) and Kaluga (Shmytova 2002). Male genitalia see figs. 43–44.

Ectoedemia (*Ectoedemia*) *hannoverella* (Glitz, 1872)

Material. Astrakhan: 1 ♂, Bogdo, 1997.05.09, KD. – Ul'yanovsk: 1♀, Mar'evka, 21.–23.vii.1999, IA & IV; 1♂, Vasil'evka, 9.–10.vi.1998, ZV; 1♂, Ul'yanovsk city, 20.vi.1990, ZV; 10 mines with larvae, Vinnovka, *Populus nigra*, 21.ix.2002, MA.

Remarks. According to Puplesis (1994) distributed from central Europe to southern Siberia (Novosibirsk), but no further detail known. Therefore these are the first detailed records for European Russia. Widespread in Central Europe. Male genitalia see figs. 45–46.

* *Ectoedemia* (*Ectoedemia*) *turbidella* (Zeller, 1848)

Material. Ul'yanovsk: 14 mines with larvae, Vinnovka, *Populus alba*, 21.ix.2002, MA

Remarks. *E. turbidella* is widespread in Europe, in Russia only previously recorded from Leningrad (Jürivete et al. 2000). EvN found also mines in St Petersburg (19.x.1985).

Ectoedemia (*Ectoedemia*) *argyropeza* (Zeller, 1839)

Material. Saratov: 3♀, Saratov, 6.v.1990, AV. – Ul'yanovsk: 5 mines + larvae, Vinnovka, *Populus tremula*, 30.ix.2002, MA. – Volgograd: 2♀, Sarepta, 19th century, Christoph (BMNH).

Remarks. A widespread Holarctic species, found in Russia abundantly in Leningrad, Moscow, Kaluga, Tatarstan and Kalinigrad (Jürivete et al. 2000; Krulikowsky 1908; Puplesis 1994; Shmytova 2002; Speiser 1903). *E. argyropeza* is parthenogenetic, males are extremely rare (Bond & van Nieukerken 1987). It occurs with *Populus tremula*, probably throughout Siberia, although up to now it is only recorded from Northeast China (van Nieukerken & Liu 2000).

Ectoedemia (*Ectoedemia*) *caradjai* (Groschke, 1944) New for Russia

Material. Volgograd: 2♀, Chapurnikovskaya balka, 21.viii.1999, KD (figs 50–51).

Remarks. A more southern species, common in southern and central Europe, north to Austria, southern Moravia (Czech Republic) and Ukraine. The mines were first discovered by Hering (1932) in Moldova, but his description was not available, because it was based on the 'work of an animal' after 1930 (International Commission on Zoological Nomenclature 1999). Feeds on several *Quercus* species.

Ectoedemia (*Ectoedemia*) *albifasciella* (Heinemann, 1871)

Material. Ul'yanovsk: 1♂, Surulovka, 1.–3.vii.1997, IA & IV; 28 mines, Vinnovka, *Quercus robur*, 21.ix.2002+undated, MA. – Volgograd: 1♂, Sarepta, 22.v.1859, Christoph (BMNH).

Remarks. This miner of *Quercus* is widespread and often very abundant throughout Europe, but rarer in south. Previously recorded from Russia in Smolensk and Kaluga (Shmytova 2002; Skala 1944). Strictly spoken, males cannot be identified with certainty from *E. contorta* Van Nieukerken, 1985 or *E. pubescivora* (Weber, 1937). We, however, regard *E. albifasciella* as the most likely candidate for these localities. Mines of this species occur usually much earlier than the following species (August–September).

* *Ectoedemia* (*Ectoedemia*) *subbimaculella* (Haworth, 1828)

Material. Ul'yanovsk: 3 mines, Vinnovka, *Quercus robur*, 2002, MA.

Remarks. A similar distribution as the previous species, and often as abundant or even more. From Russia also recorded from Smolensk and Kaluga (Shmytova 2002; Skala 1944). The leafmines of *E. subbimaculella* are very characteristic by the slit on the underside; they occur much later than *E. albifasciella*, and are often found in green islands in fallen leaves, as was also here the case.

* *Ectoedemia* (*Ectoedemia*) *atricollis* (Stainton, 1857) New for Russia

Material. Ul'yanovsk: 28 mines, Vinnovka, *Malus domestica* + *Pyrus communis*, vii.–viii, 21.ix.2002, MA.

Remarks. A widespread European species, also occurring in Tajikistan, but probably as an introduction (Puplesis 1994). Not previously recorded from Russia. This is an oligophagous species, feeding on a number of tree genera in Rosaceae (*Crataegus, Malus, Pyrus, Prunus* etc.) and on *Staphylaea* (Staphylaeaceae). Leafmine see fig. 19.

* *Ectoedemia* (*Ectoedemia*) *arcuatella* (Herrich-Schäffer, 1855)

Material. Ul'yanovsk: 34 mines, Vinnovka, *Fragaria moschata*, vii.–viii, 21.ix.2002, MA.

Remarks. This widespread European species has once been recorded as leafmines from Russia: Smolensk (Skala 1944). According to Puplesis (1994) possibly also in Tyan-Shan'. The mines on *Fragaria* are very characteristic (fig. 23), and cannot be confused with anything else.

Ectoedemia (*Ectoedemia*) *angulifasciella* complex

Material. Ul'yanovsk: 1♂, Ryabina, 22.vi.1994, ZV.

Remarks. This male is in poor condition, and the colour of the head can no longer be determined. The specimen can belong to either *E. arcuatella*, *E. rubivora* (Wocke, 1860) or *E. atricollis*.

* *Ectoedemia* (*Ectoedemia*) *spinosella* (Joannis, 1908) – New for Russia

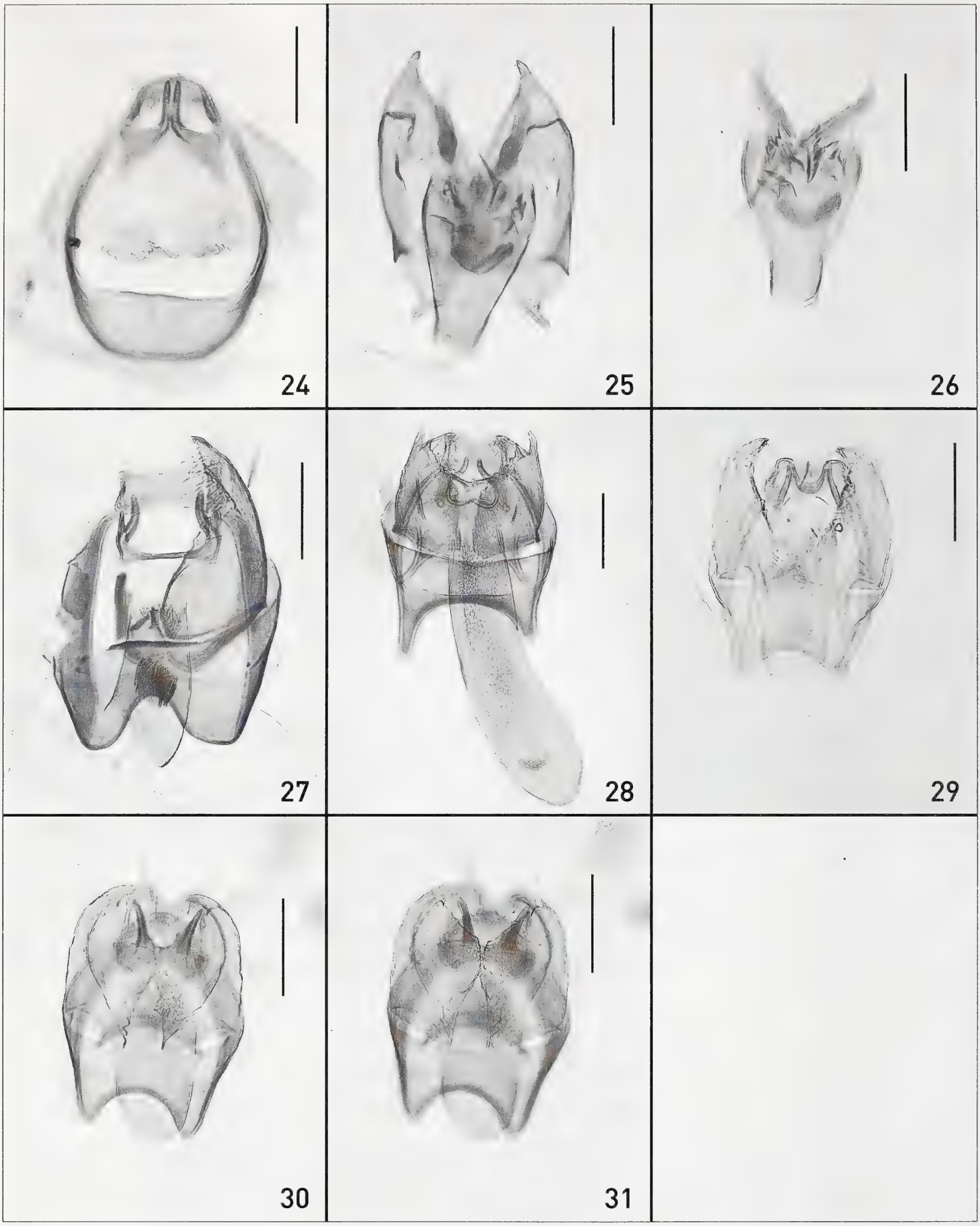
Material. Kalmyk Republic: mines, *Prunus* sp., Elista, 26.ix.2000, ZV. – Ul'yanovsk: 2 mines, Ul'yanovsk, *Prunus spinosa*, 9.ix.2002 SU; 32 mines, Vinnovka, *Prunus domestica* + *spinosa*, vii.–viii, 21.ix.2002, MA.

Remarks. *E. spinosella* is a more southern European species, reaching in the North to the southern part of Britain, The Netherlands, mid Germany and Poland. Gerasimov (1952) recorded it also from the Crimea, the Caucasus and European Part of the Soviet Union, but these records were not cited by Puplesis (1994); in the light of the present findings, they should be regarded as probably correct. Also common in western Turkmenistan (Puplesis et al. 1996). The mines are characteristic (figs. 21–22), and although they may sometimes be confused with *E. mahalebella* (Klimesch, 1936), the latter has never been found on *Prunus spinosa*. Still, confirmation by adults remains desirable.

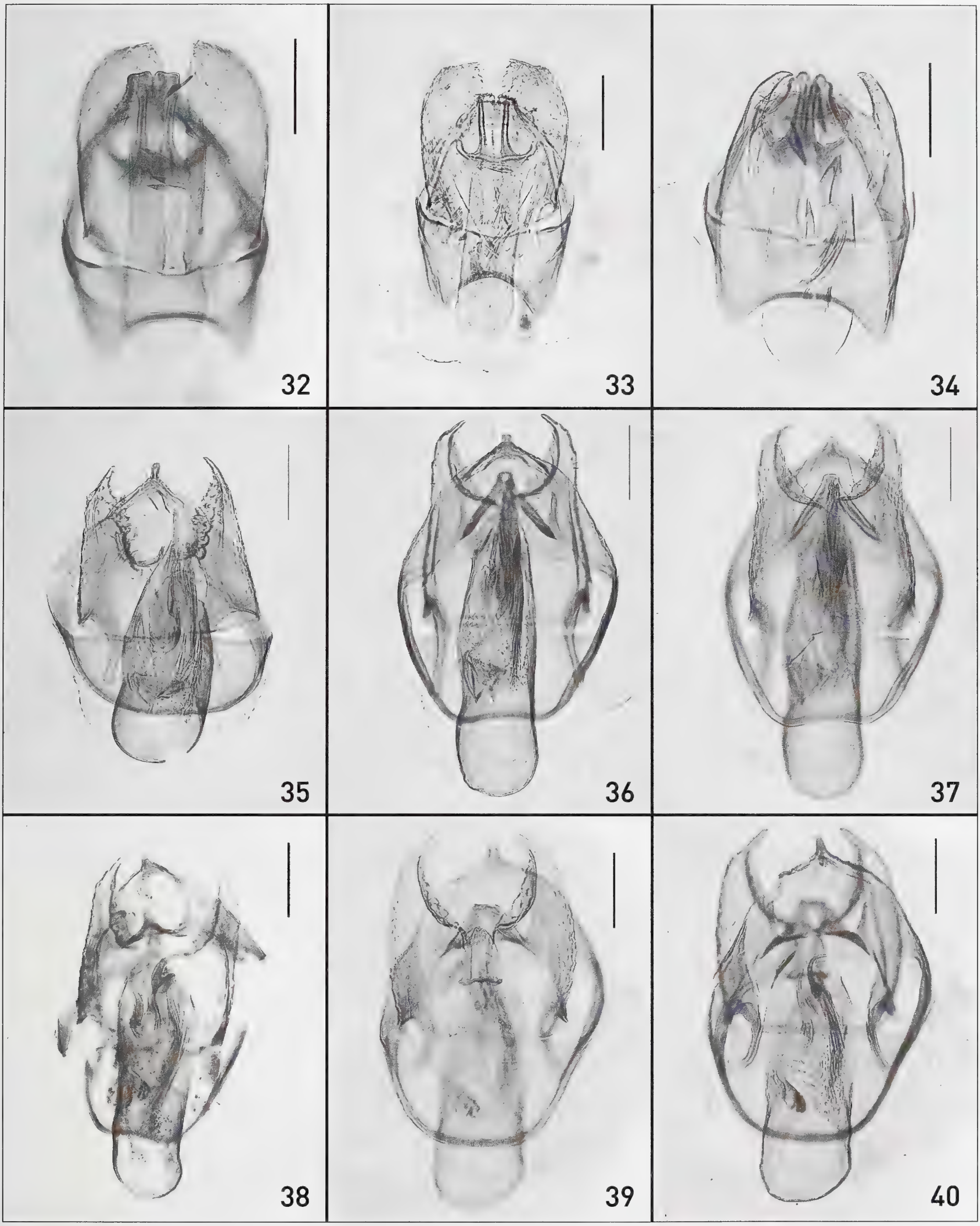
Ectoedemia (*Ectoedemia*) *occultella* (Linnaeus, 1767)

Material. Ul'yanovsk: 1♂, Baryshskaya Sloboda, 10.–12.vii.1997, *Sphagnum* peat bog, IA & IV.

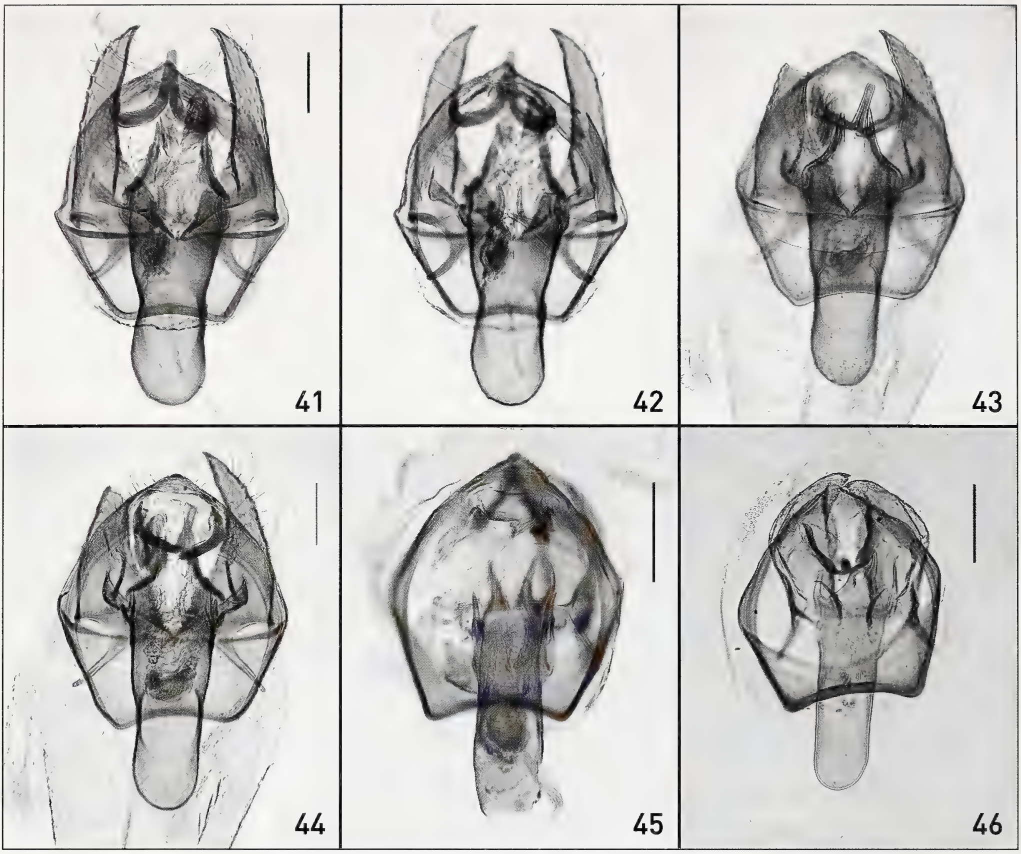
Remarks. *E. occultella* is one of the few Holarctic Nepticulidae species, throughout Europe, but also in Japan and North America (van Nieukerken 1985; Puplesis 1994). In Russia recorded from Murmansk, Karelia, Leningrad, Samara and Tatarstan (Jürivete et al. 2000; Kozlov & Jalava 1994; Krulikowsky 1908; Kutenkova 1989; Sachkov et al. 1997) and also as far east as Sakhalin (Puplesis 1994). It feeds normally on *Betula*, although it has occasionally been found on *Salix pentandra* in Finland. Very similar mines on Rosaceae in Nepal and Japan may also belong to this species.



Figs. 24–31. Male genitalia of Nepticulidae. **24–26.** *Stigmella naturnella*, Ul'yanovsk: Pobedy (EvN3302); Samara: Zhiguli (3303; fig. 26). **27.** *S. glutinosae*, Srednikovo (EvN3485). **28.** *S. aceris*, Ul'yanovsk: Pobedy (EvN3491). **29.** *S. ulmiphaga*, Chapurnikovskaya balka (EvN3329). **30–31.** *S. rolandi*, Chapurnikovskaya balka (EvN3332) (scale bars 100μm).



Figs. 32–40. Male genitalia of Nepticulidae. **32–33.** *Stigmella zelleriella*, Mar'evka (EvN3301, EvN3492). **34.** *S. obliquella*, Vasil'evka (EvN2997). **35.** *Trifurcula* (*Trifurcula*) *silviae*, Beketovka (EvN3294). **36–38.** *T.* (*T.*) *chamaecytisi*, Srednikovo (EvN3293) and Arkaim Reserve (EvN3400; fig. 38, **39–40.** *T.* (*T.*) *pallidella*, Srednikovo (EvN3300) (scale bars 100μm).



Figs. 41–46. Male genitalia of Nepticulidae. **41–42.** *Ectoedemia* (*Zimmermannia*) *liebwerdella*, Surulovka (EvN3313). **43–44.** *E.* (*Z.*) *longicaudella*, Akulovka (EvN3295). **45–46.** *Ectoedemia* (*E.*) *hannoverella*, Vasilev'ka (EvN3310) and Bogdo (EvN3339) (scale bars 100μm).

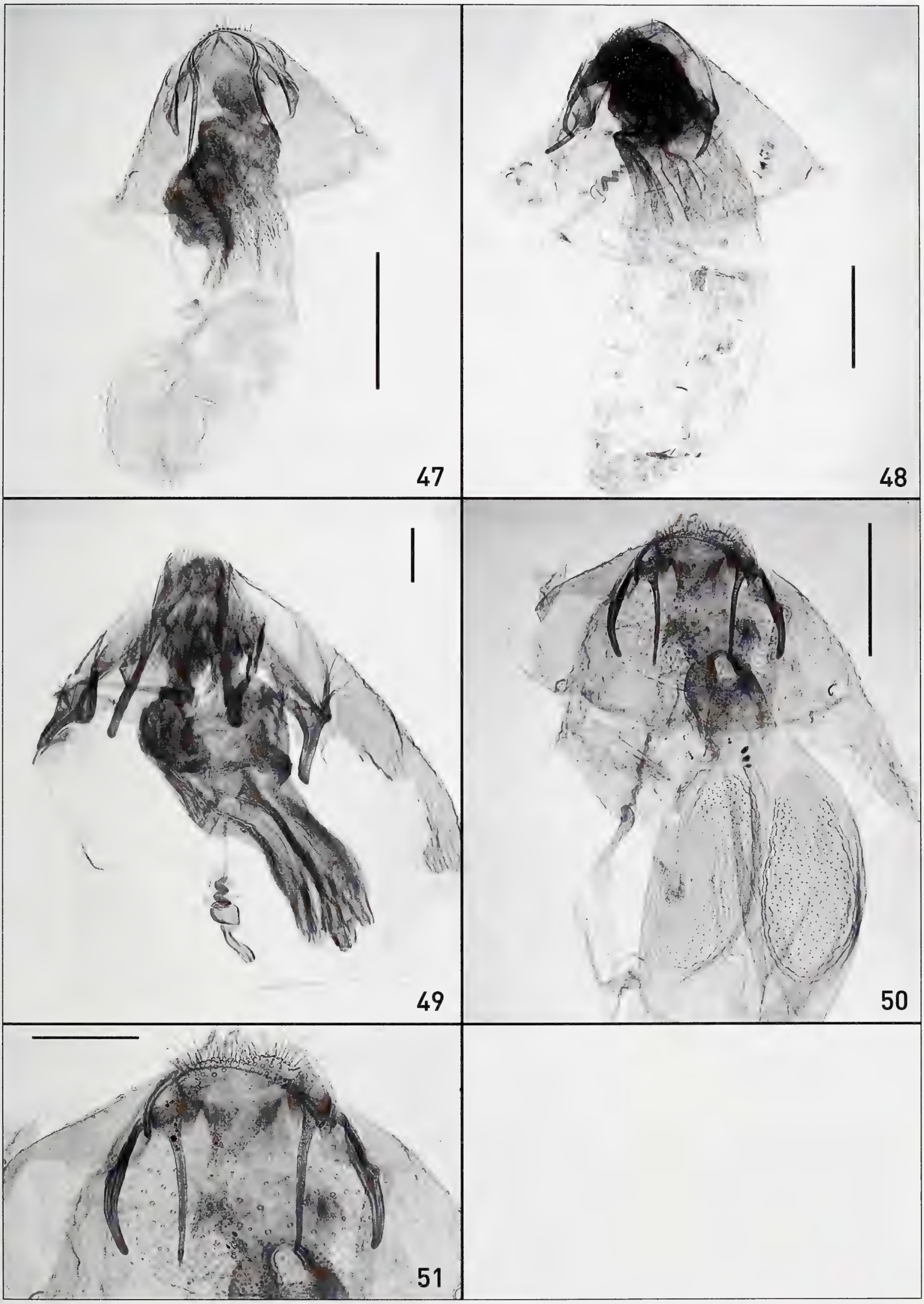
Doubtful records

We list here some leafmines, which we cannot identify with certainty, but which provide an insight in the total fauna.

Pyrus. – Kalmyk Republic: mines, *Pyrus communis*, Elista, 26.ix.2000, ZV. – Ul'yanovsk: 2 mines, Arbuzovka, 30.viii.2002, ZV; many mines, Vinnovka, vii.–viii.2002, MA.

The mines in Ul'yanovsk can be split more or less into two groups, which could belong to *Stigmella desperatella* (Frey, 1856) and *S. pyri* (Glitz, 1865); the material from the Kalmyk Republic resembles more *S. minusculella* (Herrich-Schäffer, 1855), but the mines cannot be identified with any certainty.

Puplesis (1994) records *S. minusculella* from southern Russia, based on material from Belgorod (R. Puplesis, pers. comm.), but the other two species have not yet been recorded from Russia, although *S. desperatella* is common in the Caucasus.



Figs. 47–51. Female genitalia of Nepticulidae. **47.** *Stigmella aceris*, Chapurnikovskaya balka (EvN3335). **48.** *Trifurcula* (*Trifurcula*) *subnitidella*, Arkaim Reserve (EvN3402). **49.** *T.* (*T.*) *beirnei*, Bakhilova Polyana (EvN3322). **50–51.** *Ectoedemia* (*E.*) *caradjai*, Chapurnikovskaya balka (EvN3337) (scale bars 200 μm for figs. 47, 48, 50, 100μm for figs. 49, 51).

Filipendula vulgaris. – Ul'yanovsk: 5 mines, Arskoe, 20.viii.2003, MA.
Leafmines in *Filipendula vulgaris* are normally not identifiable, and they could belong to either *S. thuringiaca* or *S. filipendulae* (Wocke, 1871). The latter is not yet known from Russia.
Rosa. – Ul'yanovsk: 7 mines, Tsemzavod, mid vii.2003, MA.
Stigmella mines on *Rosa* are usually undistinguishable, and could belong to either *S. anomalella* (Goeze, 1783) or *S. centifoliella* (Zeller, 1848). *S. rolandi* also feeds on *Rosa*, but has probably slightly different mines. *S. anomalella* is the most likely candidate here, it is reported from Leningrad and Samara (Puplesis 1994; Sachkov et al. 1997), and occurs further east in Tyan-Shan' and Primorskiy Kray (Puplesis 1994).

Rubus. – Ul'yanovsk: 1 mine, Ul'yanovsk city, 9.ix.2002, SU; 5 mines, Vinnovka, vii.–viii.2002, MA.
Mines of *Stigmella splendidissimella* (Herrich-Schäffer, 1855) and *S. aurella* (Fabricius, 1775) are very hard to distinguish, we therefore cannot attribute these mines with certainty to any of the species, although in view of the distribution the first seems the more likely candidate.

Ulmus. – Ul'yanovsk: 3 mines, Ul'yanovsk city, 9.ix.2002, SU.
We think that these mines belong most likely to *S. ulmivora* (Fologne, 1860), but since mines of *S. ulmiphaga* and *S. kazakhstanica* cannot be distinguished, we do not put any final identification to these mines. Similar mines from Samara have been reported as *S. ulmivora* (Sachkov et al. 1997).

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Peter Huemer 2004. Die Tagfalter Südtirols. – Veröffentlichungen des Naturmuseums Südtirols 2: 232 pp. – Hardcover (ISBN 3-85256-280-5). 44,40 €. (in German)

The butterflies of South Tyrol in northern Italy are now treated in the book "Die Tagfalter Südtirols" by Peter Huemer. South Tyrol, situated in the eastern Alps, comprises an area of just 7,400 km^2, but altitudes extends from 210 m to 3902 m providing extreme different habitats. Still until the 1970s, South Tyrol was famous as a paradise for Lepidoptera, but since that time man occupied much more land, especially for settlement and apple plantations. However, the impact of these changes on the composition of the butterfly species communities was not well known yet. For three years, Peter Huemer studied the relevant faunistic literature from the very beginning in the late 18th century to the beginning of the third millennium. Further, he studied south tyrolian butterflies in several institutional and private insect collections and went out himself to look for rarely recorded species, visiting localities where certain butterfly species occurred formerly or investigated areas from which butterflies have rarely been recorded. After all, the butterfly fauna of South Tyrol comprises 185 species (after elimination of doubtful records). The book starts with a general chapter, giving an introduction into geography, geology, climate, and vegetation of South Tyrol, methods used and a summary of the main results, e.g., occurrence of butterflies at different altitudes, ecological adaptation of the species and threats. The main chapter treats the species. For every species, information is given for identification, general distribution, regional occurrence, habitat, phenology, larval food plants, life history, and threats including recommendations for conservation. Records from South Tyrol are shown on relief maps and are distinguished between those made either before or after 1980. The book is completed by a list of references cited, a systematic index of the taxa, an alphabetic index of the scientific names and an alphabetic index of the German names.

The book is printed in colour throughout. More than 100 butterfly species are figured by colour photos taken from living specimens in nature, plus images from immatures and butterfly habitats. The text is written concisely and full of information. Among others, the reader will learn about *Libythea celtis* (Laicharting, 1782), which is the first lepidopterous species originally described from South Tyrol. At the beginning of the 20th century, it was still that common that it was mentioned as a pest, but it is regarded as endangered today. Its larval food plant, *Celtis australis*, naturally growths in the same areas which are especially suitable for apple. The displacement of natural stands of *Celtis australis* by apple orchards and the use of pesticides are therefore regarded as the main threats for the decline of *Libythea celtis*. Indeed, a summary of the main threats for the butterflies of South Tyrol lists agricultural management including the use of pesticides, intensive forestry, and urban settlement. Fortunately, the highest number of butterfly species can be found between 1000–1500 m altitude, an area which is not in favour for these activities by man and this holds much more true for alpine species. A revised version of the regional red data book of the 185 butterfly species lists 11 species as regionally extinct, 8 are critically endangered, 8 are endangered, 10 are vulnerable, 46 are nearly threatened, 70 are least concern, and for 25 species the data are deficient.

"Die Tagfalter Südtirols" by Peter Huemer is a basic tool for all who are interested in the butterflies from South Tyrol and their conservation. It is scientific and popular. The book has a high potential to fascinate South Tyrolians and especially young people for their native butterflies. They will find all necessary information in this lovely made book to start studying these creatures in nature. And this is what sustainable conservation of butterflies needs today: beginners.

MATTHIAS NUSS

Trifurcula pallidella (Duponchel, 1843) (Nepticulidae): distribution, biology and immature stages, particularly in Poland

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Abstract. *Trifurcula pallidella* (Duponchel, 1843) is recorded for the first time from 30 localities in south-eastern Poland. The biology is described and illustrated in detail for the first time: the larva makes spindle shaped galls in stems of *Chamaecytisus* spp., *Lembotropis nigricans*, and *Cytisus procumbens*. In Poland it is usually found on dry grassland or edges of woodland on calcareous soils. The larva, pupa and galls are described and illustrated. The distribution is revised and mapped on the basis of material and literature: its occurrence in Germany: Bavaria, Italy mainland and Sicily is confirmed, and new records are given for Corsica and Crete. It is widespread from Southeast Poland southwards throughout the Balkans and eastwards to the Volga, in the West to Regensburg in Germany, southern Switzerland, western Italy and Corsica. It is believed to use a different host in Mediterranean localities, possibly *Calicotome*. All known hosts and *Calicotome* belong to the monophyletic *Cytisus* group of recent molecular studies.

Zusammenfassung. *Trifurcula pallidella* (Duponchel, 1843) wird erstmals aus 30 Fundorten in Südostpolen gemeldet. Die Biologie wird zum ersten Mal detailliert beschrieben und abgebildet: die Raupe macht spindelförmige Galle im Stengel von *Chamaecytisus* spp., *Lembotropis nigricans*, und *Cytisus procumbens*. In Polen wird die Art meistens in Trockenrasen oder an Waldränder auf Kalkuntergrund gefunden. Die Raupe, Pupe und Galle werden beschrieben und abgebildet. Die Gesamtverbreitung wird auf Grund von Material und Literatur revidiert und auf einer Karte abgebildet: das Vorkommen in Deutschland: Bayern, auf dem Italienischen Festland und Sizilien wird bestätigt, und die Art wird von Korsika und Kreta neu nachgewiesen. *T. pallidella* ist weit verbreitet, von Südostpolen bis über die Balkanhalbinsel im Süden und nach Osten bis zur Wolga, im Westen bis Regensburg in Deutschland, die Südschweiz, Westitalien und Korsika. Es wird angenommen dass *T. pallidella* im Mittelmeerraum andere Futterpflanzen nutzt, wahrscheinlich *Calicotome*. Alle bekannten Futterpflanzen und *Calicotome* gehören zur monophyletische *Cytisus*-Gruppe die auch in rezenten molekularen Studien anerkannt wird.

Key words. *Trifurcula*, distribution maps, hostplants, galls, *Cytisus, Lembotropis, Chamaecytisus, Calicotome*, Fabaceae, Genisteae, Braconidae, *Mirax*.

Introduction

The genus *Trifurcula* Zeller, 1848 includes at least 36 named species in Europe (van Nieukerken 1996), particularly in the Mediterranean region, where also many unnamed species are known. More to the north the number of species is quickly decreasing, still sixteen species are found in the Czech Republic, eleven in Germany, seven in Denmark and five in Sweden. Only six species have been cited from Poland, which probably is an underestimate of the real number. The subgenus *Trifurcula* s. s. comprises a group of rather uniform moths, of which the larvae make stem-mines on Fabaceae (=Leguminosae). Two species groups are recognised: the *T. subnitidella* group which feeds on plants belonging to various Fabaceae tribes (i.e. *Lotus,*

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Figs. 1-4. Habitats of *Trifurcula pallidella*. **1–2**. Poland, Podlasie: Stare Stulno, May 2003, grassland on a sand dune, hostplant *Chamaecytisus ruthenicus*. **3**. Poland, Lublin Upland: Brzeźno reserve, May 2003, calciphilous community at the margin of a marsh, hostplant *C. ruthenicus*. **4**. Slovakia, Plešivec, Slovenský Kras: Hôrka, October 1992, a dry calcareous hill with grassland, hostplant *C. hirsutus* (not visible on photograph). Photos M. Sielezniew (**1–3**), E.J. van Nieukerken (**4**).

Dorycnium, Coronilla), but not on brooms (tribe Genisteae), and the *T. pallidella* group, which is specialised on brooms.

The type species of *Trifurcula*, *T. pallidella* (Duponchel, 1843) is one of the largest species in the genus and one of the oldest known. Taxonomy and distribution were discussed by van Nieukerken & Johansson (1986), especially in relation to *T. beirnei* Puplesis, 1984, which previously had often been misidentified as *T. pallidella*. At that time the biology was unknown, although it was presumed that *T. pallidella* is associated with *Lembotropis nigricans* (L.) Griseb.

Shortly after that, the larvae were discovered by the senior author during a joint excursion with Aleš and Zdeněk Laštůvka. The larvae make galls in *Lembotropis nigricans* and *Chamaecytisus* spp. and later galls were also found in *Cytisus procumbens* (Waldst. & Kit. ex Willd.) Sprengel (=*Corothamnus procumbens*). The gall is shown and briefly described by A. & Z. Laštůvka (1997). The two Polish authors have found adults and galls of *Trifurcula pallidella* in several places in Poland since 1998. On the basis of these records the species was listed as occurring in Poland by Buszko & Nowacki (2000). We here report the Polish records in particular and provide details on the biology, immature stages and distribution in Poland and in Europe, where many new data have become available since 1986.

Material and methods

The first two Polish males of *T. pallidella* were found amongst material collected at light in xerothermic habitats in south-east Poland in 1998. In late autumn (20 October) of the same year, several empty galls were found in stems of *Lembotropis nigricans* and *Chamaecytisus ruthenicus* (Fischer ex Wołoszczak) A. Klásková in steppe vegetation in Machnów. The distribution of the host plants (Zając & Zając 2001) suggested that the species may have a wider range in Poland. Therefore we started detailed field investigations in 2001-2002 in order to test this hypothesis. A number of localities where the hostplants were expected were selected; these had similar biotic conditions as those mentioned above. Most of these sites are located in existing or planned nature reserves. We visited these sites from mid-September to mid-October: the period when the galls with larvae were expected. Some live material was also sent to the senior author, who reared a couple of specimens as well.

The senior author collected *T. pallidella* in the Czech and Slovak Republics in 1992 in collaboration with A. and Z. Laštůvka on localities were adults had been found previously. Other material studied was found during study of many museum and private collections since 1986, and some data were received from A. and Z. Laštůvka. He also re-examined all known literature citations.

Galls were collected by cutting parts of the stem of the hostplant. The stems were placed in plastic containers lined with tissue. Most larvae easily prepared cocoons on the tissue, after which the stems were removed and dried. Adults and parasites emerged after a winter diapause in an outhouse.

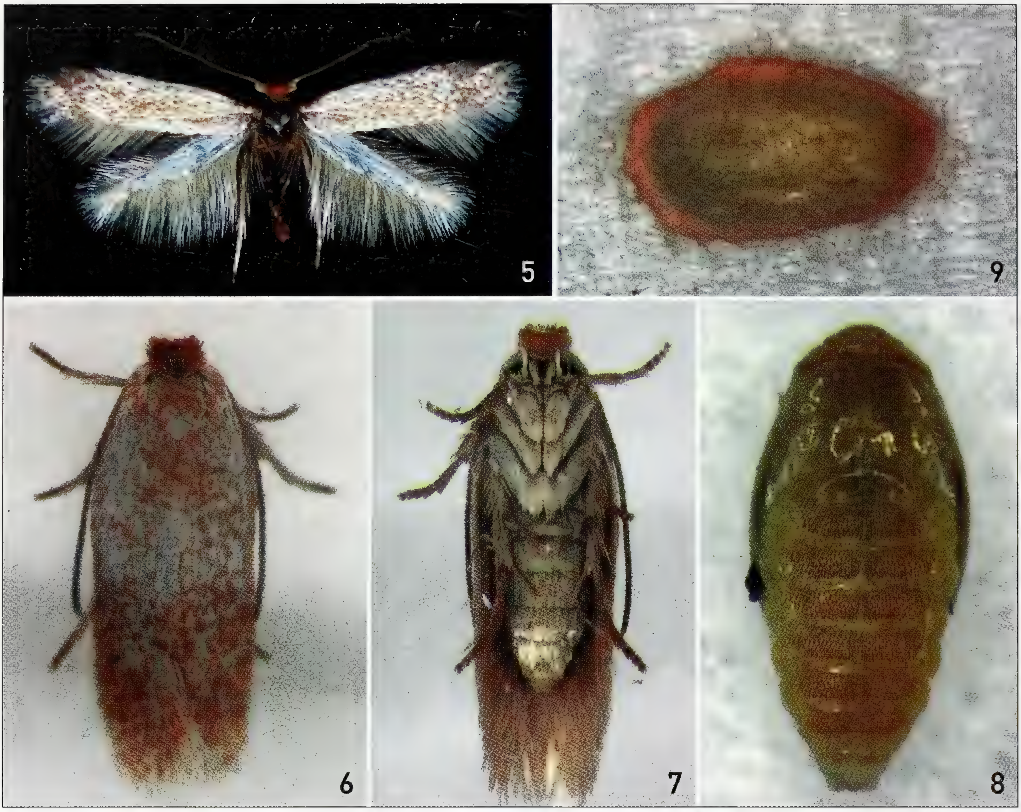
Larvae and pupal skins were examined after macerating in KOH and mounted on slides with euparal, after dehydration with ethanol and staining with chlorazol black and haemaluin. Galls were studied by simply cutting them with razor blades.

Morphological terms of larvae follow Gustafsson (1981), except for the naming of setae on the mesothorax, which follows Hoare (2000), in exchanging resp. the names of D1 and D2 and SV1 and SV2. Homologisation of setae, however, remains problematical. For this reason the ventral group of setae is not labelled in Fig. 21.

Photographs of preparations of immature stages and genitalia were taken with a Zeiss AxioCam digital camera attached to a Zeiss Axioskop H, those of live insects and galls by EvN with the same camera on Zeiss Stemi SV 11, using Carl Zeiss AxioVision 3.0.6 software. Galls were photographed by KP with a Canon D10 digital camera, with a standard lens. The adult moth was photographed with an Olympus DP10 digital camera attached to the stereo-microscope Olympus S260.

The European distribution map was prepared with Dmap 7.0 (Morton 2000). In Tab. 1 and 2 we give summarized locality data, all details of these, dates and UTM coordinates with an accuracy of 10 square kilometres are given in an excel sheet on the website of the senior author (http://www.naturalis.nl/nieukerken) and on the website of the journal (http://www.soceurlep.org/council-main.htm). When coordinates were not available from the source, we obtained most from NIMA (2004).

Depositories of collections are abbreviated according to Evenhuis & Samuelson (2004). For the hostplant names we follow Heywood & Ball (1968). Although since then there



Figs. 5–9. *Trifurcula pallidella.* **5.** Male, Poland: Stawska Góra res. **6–7.** Live female, Poland, Góry Pieprzowe res., emerged in Leiden. **8.** Live pupa, dorsal view, Poland, Stawska Góra res. **9.** Cocoon on tissue, Góry Pieprzowe res. Photos: J. Chobotow (**5**), E.J. van Nieukerken (**6–9**).

has been much discussion on the generic limits within the *Cytisus* group and the Genisteae in general, no consensus has been reached, and there is not another easy single source except the ILDIS database (ILDIS 2003), which uses a somewhat inconsistent nomenclature. The genera *Lembotropis* and *Chamaecytisus* as used here are often (but not always in the same paper) regarded as sections of *Cytisus* (resp. sect. *Lembotropis* and *Tubocytisus*), and the section *Corothamnus* in *Cytisus* (for *C. procumbens*) is in some publications raised to genus. In recent molecular studies, cited below, a large *Cytisus* seems to be paraphyletic, but also the genus *Chamaecytisus* as currently understood appears as polyphyletic (for a revision of this taxon see Cristofolini 1991).

RESULTS

Trifurcula pallidella (Duponchel)

Oecophora pallidella Duponchel, [1843]: 339, pl. 78. Lectotype selected by van Nieukerken & Johansson 1986.
Trifurcula pallidella; Zeller 1848: 332.
Trifurcula incognitella Toll 1936: 409.
Trifurcula pallidella; van Nieukerken & Johansson 1986: 271.

Diagnosis. Wingspan 7.5–9 mm. Head: frontal tuft from almost white, yellowish orange to brown ferruginous, collar white to straw, occasionally with a few darker scales. Scape straw to ferruginous orange, flagellum grey-ochreous indistinctly ringed, 42–50 segments. Thorax and forewings uniformly coloured, covered with two types of scales: white and ferruginous-tipped scales, sometimes with golden gloss. The ferruginous-tipped scales usually becoming more abundant towards apex. The general impression of the wing colour varies from white to ochreous, depending on abundance of scale type. Hindwing grey with straw cilia. Abdomen grey dorsally, straw ventrally.

Similar species. Of the species with which it can be found together, *Trifurcula pallidella* resembles *T. beirnei* most; this can in many cases be differentiated by the different flying period: *T. pallidella* occurs from May to early (mid) July, *T. beirnei* usually in August to September. However, there are a few earlier records of *T. beirnei*, thus July specimens need to be checked carefully. *T. beirnei* is on average larger (8–11 mm) than *T. pallidella*, and has three types of scales (white, yellow and dark tipped). The characteristic gnathos and large curved valvae of *T. beirnei* can often be seen without dissection.

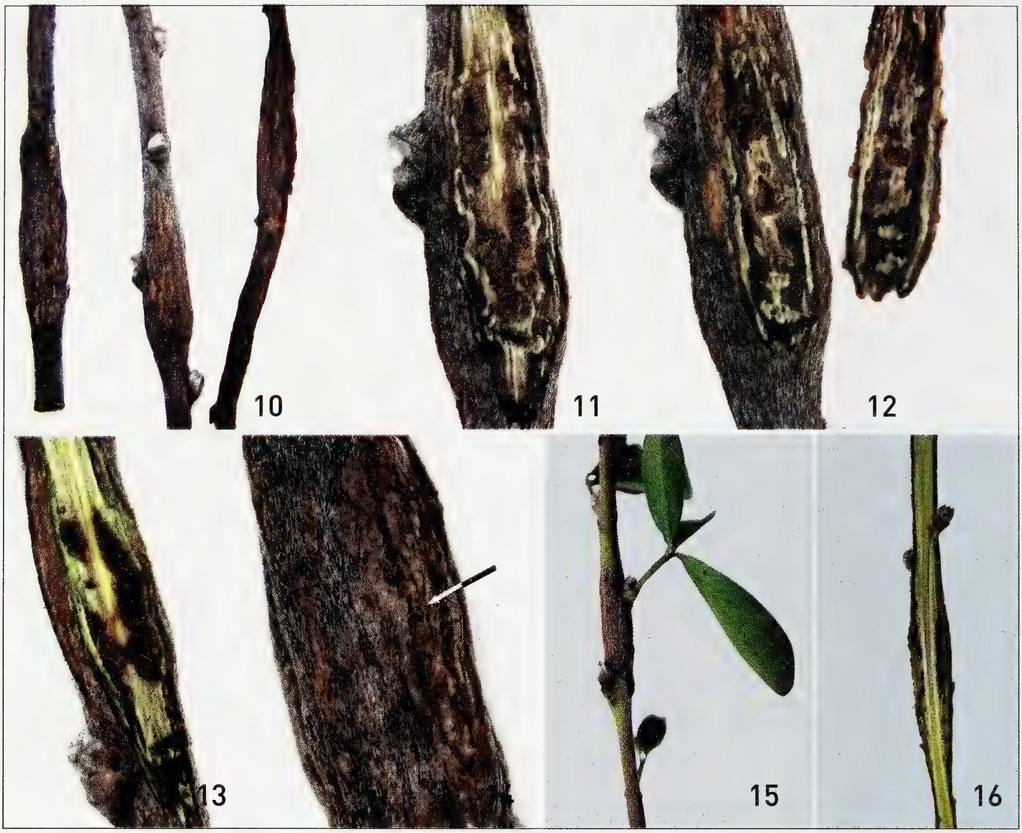
Most other species likely to confuse with *T. pallidella* belong to the *T. immundella* complex of species, and of these *T. immundella* (Zeller, 1839) and *T. chamaecytisi* Z. & A. Laštůvka, 1994 resemble *T. pallidella* most, but larger and worn specimens of the other species may also be confused. Most of these species, except *T. immundella*, feed on the same hosts as *pallidella*, and can therefore be found in the same localities. These species are on average somewhat smaller (6–8.5 mm, sometimes even smaller), and apart from *T. chamaecytisi*, they are darker when fresh. In collections *T. pallidella* was often confused with the much smaller (5–7 mm) *T. serotinella* Herrich-Schäffer, 1855. The male genitalia offer the best characters, for descriptions and illustrations we refer to van Nieukerken & Johansson (1986), but we also illustrate here the male genitalia (Fig. 17).

Life history

Hostplants. With certainty galls are now recorded from *Chamaecytisus albus* (Hacq.) Rothm., *C. austriacus* (L.) Link, *C. hirsutus* (L.) Link, *C. ratisbonensis* (Schaeffer) Rothm., *C. ruthenicus* (Fischer ex Wołoszczak) A. Klásková, *Cytisus procumbens* (Waldst. & Kit. ex Willd.) Sprengel (in section *Corothamnus*) and *Lembotropis nigricans* (L.) Griseb.

Galls. The galls with full-grown larvae were found from 9 September to early November. Galls occurred at different heights in the stem, both in older shoots and younger shoots of the same year. Occasionally two or three galls were found in the same stem. Old galls remain visible and can still be found in the next spring, at least until June (see Tab. 1 and 2).

The egg is deposited on the stem where later the gall forms, usually difficult to see. The larva first bores into the parenchyma and then feeds in a spiral gallery around the stem, successively moving upwards, also partly boring in the central woody part of the stem (Figs. 10–16). The stem is thickened more or less considerably by the larval



Figs. 10–16. *Trifurcula pallidella*, biology, galls and details, **10–14.** *Chamaecytisus ruthenicus*, Korhynie (11: Osłowo), **10.** Three galls. **11–13.** Various sections. **14.** Exit hole, indicated by arrow. **15–16.** Galls in *Lembotropis nigricans,* Stawska Góra res. Photos E.J. van Nieukerken (**10–14**), K. Pałka. (**15, 16**).

activity. The diameter of the galls varies from 3.2–6.0 mm (depending on stem thickness) and the length from 13-26 mm (n=20). The frass is deposited in the gallery (Figs. 11–13), in a similar fashion as in stem-mines of related *Trifurcula* species, almost filling the gallery.

The full fed larva quits the gall through a slit in its upper part, usually close to a stem bud (Fig. 14). The pupation takes place in a typical Nepticulidae cocoon (Fig. 9). Cocoon length is 2.7–3.7 mm (mean 3.3 mm, n=20), width 1.8–2.5 mm (mean 2.1 mm, n=20). Its colour is pale brown to ferruginous brown. In captivity the cocoons were attached to the walls of the rearing tubes, to the surface of a stem or on pieces of paper tissue. After hibernation in outdoor temperature, the adults emerged from the middle of May to early June.

Voltinism. The moths fly in central Europe from 9 May to 19 July, most in May and June, in southern Greece and Crete they fly from 9 April to 17 May, but also 10 June in northern Greece. The species is clearly univoltine.

Parasites. We reared several parasites of the family Braconidae, all belonging to *Mirax rufilabris* Haliday, 1833 (det. C. van Achterberg, Leiden). They emerged in the

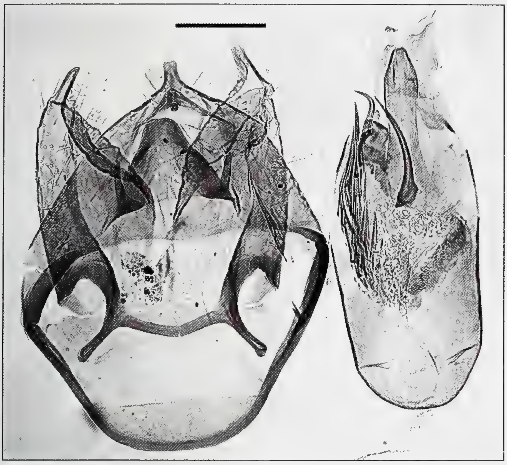


Fig. 17. *Trifurcula pallidella*, male genitalia, Germany: Kelheim, slide EJ7919. Scale 100µm.

laboratory between 9 April and 13 June 2003. We also reared just one specimen of Eulophidae, probably *Chrysocharis* sp. (5 June 2003). All these were reared out of the cocoons and thus both species are koinobionts. *Mirax rufilabris* has been recorded from many Nepticulidae species, including *Trifurcula immundella* (Shaw & Askew 1976), but it is now understood that *Mirax* forms a complex of several species with a narrower host range, of which a revision is in preparation (C. van Achterberg, pers. comm.).

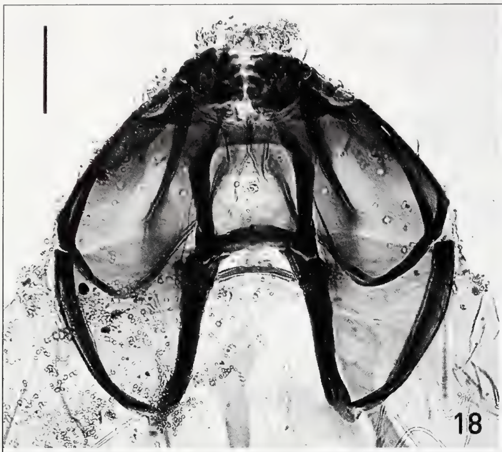
The type locality of *M. rufilabris* is Ireland, probably near Dublin. Haliday renamed it later *M. spartii*, an indication that he reared it from broom and thus from the only nepticulid known to feed on broom in Ireland: *T. immundella* (see Emmet 1976). According to C. van Achterberg, the 'real' *M. rufilabris* was up to now only known from *Trifurcula immundella*, and *T. pallidella* thus comprises a new host record. We may therefore assume that *M. rufilabris* is specialised on *Trifurcula* species that feed in the stem of brooms (see Tab. 1).

The rate of parasitism was high: from the material collected in autumn 2002 we reared 57 specimens of *Mirax*, one of *Chrysocharis* and only thirteen adults of *T. pallidella*.

Remarks. The galls were discovered by the senior author during joint field work with Aleš and Zdeněk Laštůvka in Vranovice, Moravia, 5 October 1992. In this locality adults were previously frequently caught around *Chamaecytisus ratisbonensis*. After failing to localise any stem-mines, he opened some spindle-shaped galls, and found to his surprise nepticulid larvae in it. Later several adults were reared from galls of various localities. These galls had also been noted and described before by Baudyš (1925) and Černik (1942), who found them in various localities in Moravia and Slovakia (Tab. 2). The larva was identified as 'unknown Microlepidopteron', and also cited in the handbook by Buhr (1964: 422) under *Cytisus* as number 2225. The galls are probably not induced by the egg-laying activity of the adult, but by the feeding larva; since it seems that the larva is not depending on tissue formed in the gall (but this needs to be checked more carefully). This type of thickening should not be called a gall according to some authors.

Description of immature stages

Larva (Figs. 18–21). Mature larvae about 6–8 mm long, extremely slender, yellow when fresh. Body almost completely smooth, small spines (microtrichia) absent. Headcapsule 400–480 µm long, 440–515 µm wide (n=2), much wider than long. Labrum with 2 pairs of setae; mandibula with 4 strong cusps; labial palpus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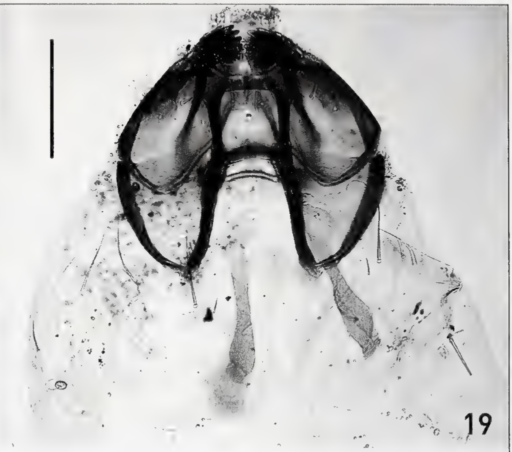
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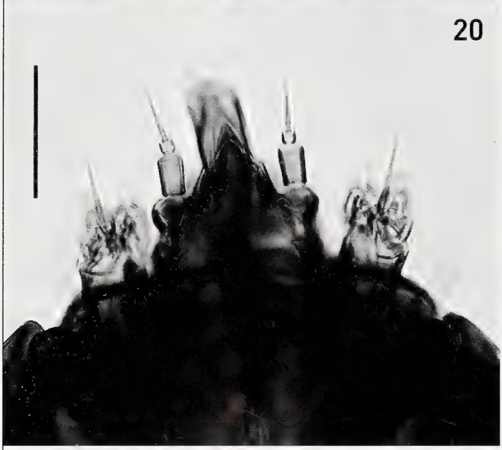

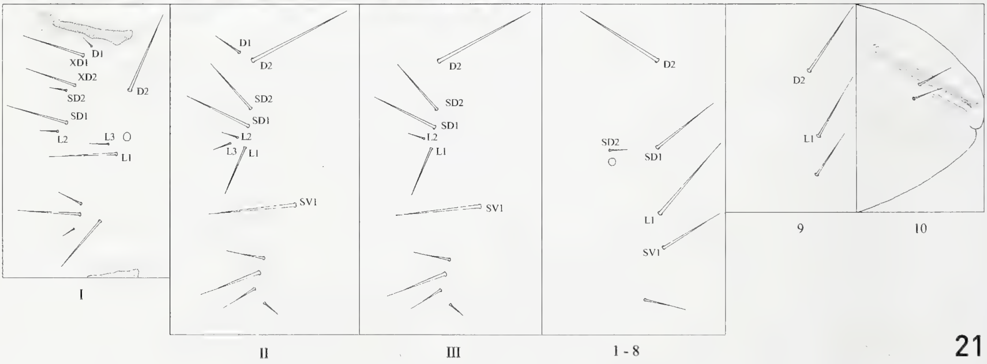

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Figs. 18–21. *Trifurcula pallidella*, larva, Stawska Góra res. **18.** Headcapsule, dorsal; scale 100µm. **19.** Headcapsule and prothorax, ventral; scale 200 µm. **20.** Detail of mouthparts, with labial palps; scale 50µm. **21.** Setal map, drawn by A. Mazurkiewicz & K. Pałka. Photos E.J. van Nieukerken.

with 3 segments and long terminal seta, second segment much longer than segment 1 or 3. Prothorax with pair of slender tergites and single indistinct sternite plus two small sternites anterolateral to the medial one; with the full complement of 13 pairs of setae. Mesothorax with 12 pairs of setae (D1 present, 4 pairs of setae ventral to SV1), metathorax with 10 pairs (D1 and L3 absent). Abdominal segments 1-8 with 6 pairs, A9 with 3 pairs and A10 with 2 pairs. Distribution of setae illustrated in setal map (Fig. 21). Paired ventral ambulatory calli present on T2–3 and A1–7. Anal rods in A10 posteriorly bifid, forming an angle of almost 180°.

The larva differs from other described *Trifurcula* (s. str.) (Gustafsson 1981; Gustafsson & van Nieukerken 1990) by the large headcapsule, which is wider than long, the complete absence of microtrichia, the presence of D1 (named D2 by Gustafsson) on the mesothorax and the labial palpus which has a very long segment 2, but otherwise confirms with the generic description. Only *Trifurcula (Glaucolepis) headleyella* (Stainton, 1854) and *T. (T.) subnitidella* (Duponchel, 1843) have also 12 setal pairs on the mesothorax, the other studied Nepticulidae have only 11 (Gustafsson 1981; Gustafsson & van Nieukerken 1990; Hoare 2000). No setal map of a species of *Trifurcula* (s. str.) had been published previously.

Pupa (Figs. 8, 22–24). Pupal exuviae examined. Frons protruding slightly into conical projection, eyecaps large, at eclosion torn from frons. Abdominal tergites 2–8 covered with many spines, in about 3 to 5 rows per segment, but not arranged in distinct rows. Cremaster with two small hooks.

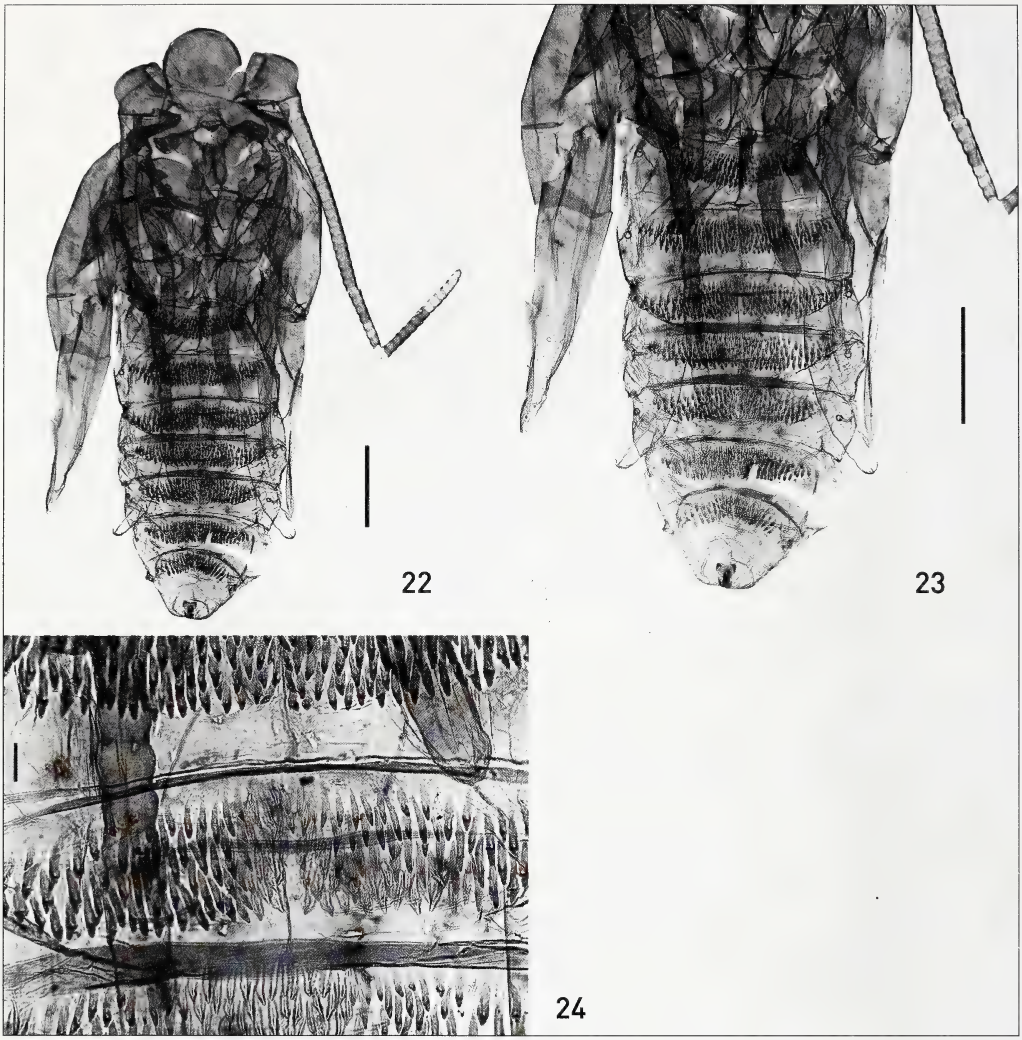
Distribution

Localities in Poland (Fig. 25). As a result of our studies, *T. pallidella* was found in 30 localities in south-east and east Poland. They are listed in Tab. 1 and presented on a map (Fig. 25).

The species reaches in Poland its northern distribution limits. The locality Grzybowce is the northernmost locality of this species in central Europe, but the Russian record in Ul'yanovsk Oblast is just a little further to the North.

European distribution (Fig. 26). In Tab. 2 we present all more or less reliable literature records and material seen by EvN or identified by colleagues sorted by country and locality. Since the previous revision of this species (van Nieukerken & Johansson 1986), many more data have become known, from which it appears that the previous suggestion that 'literature records can not be used at all' was too rigid. It is clear that the name *T. pallidella* was incorrectly used for *T. beirnei* in Great Britain, Denmark and parts of Germany and Poland. We have now also established that all previous records from France, Portugal and Spain are incorrect (van Nieukerken *et al.* 2004a, 2005): they are misidentifications for a number of pale *Trifurcula* species including *T. immundella*. From the overlapping part of the distributions of *T. pallidella* and *T. beirnei*, the records from Austria: Stelzing (Zeller in Krause 1871), Germany: Altenburg (Krause 1871; Borkowski 1975) and Poland: Sobótka (Zobten) (Wocke 1874; Puplesis 1984) definitely apply to *T. beirnei*. Two of the four localities on the Monte Baldo (Burmann & Huemer 1998), namely those in higher altitudes, refer to an unnamed species that is associated with *Genista radiata* (L.) Scop. (= *Cytisanthus radiatus*) (P. Huemer, *in litt.*) Other sources are reconsidered here in Tab. 2.

Many of the records presented in Tab. 2 are corroborated by either original material



Figs. 22–24. *Trifurcula pallidella*, pupal skin, dorsal view, Korhynie. Scales 500µm, 50µm (**24**). Photos: E.J. van Nieukerken.

or later findings. Others which have not been corroborated, are quite likely to be correct, but confirmation is still required (Italy: Pisa, Croatia, Macedonia, Rumania): they are all within the area where the known hosts occur and where the occurrence of *T. pallidella* is likely. Most problematic are records at the margin of the distribution area. The occurrence in Germany: Regensburg was previously doubted, and Segerer (1997) wrote: 'unüberprüfbare Angabe'. However, the occurrence in Germany is here corroborated by three specimens from three localities in Bavaria, including Regensburg (see Fig. 17). The record from Baden-Württemberg (Wörz 1958) has still to be rejected; it is a curious misidentification: upon checking, the specimen (coll. SMNS) appears to be a worn female of *Stigmella floslactella* (Haworth, 1828).

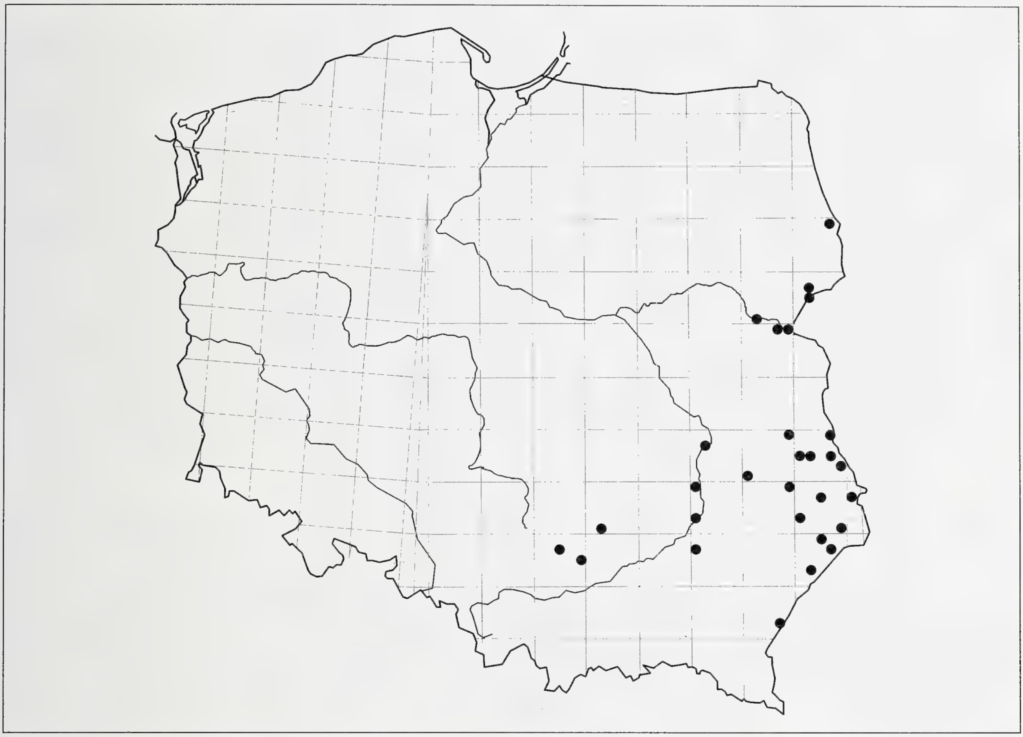


Fig. 25. Distribution of *Trifurcula pallidella* in Poland on 10km squares of the UTM grid.

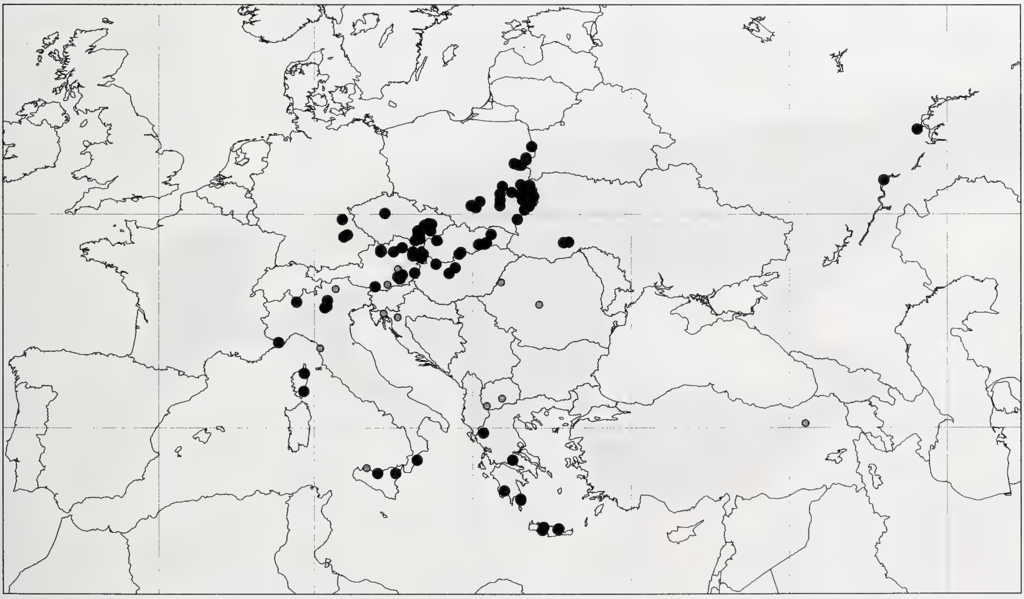


Fig. 26. Distribution of *Trifurcula pallidella*. Small grey circles: unconfirmed but not rejected literature records, large black circles: records confirmed by material, or reliable literature records. Grey shading gives the combined distribution of the hosts *Lembotropis nigricans* and *Chamaecytisus* spp. of the series *Tubocytisus* s. str. (Cristofolini 1991).

Tab. 1. Localities of *Trifurcula pallidella* in Poland and rearing results. UTM coordinates given as 10km squares, all in zone 34U. Hostplants: *Ca* = *Chamaecytisus albus*, *Cra.* = *C. ratisbonensis*, *Cru* = *C. ruthenicus*, *Ln*= *Lembotropis nigricans*. Other abbreviations: Chr. = *Chrysocharis* sp. (parasite), M = *Mirax rufilabris* (parasite), * = material sent to and reared in Leiden (in coll. RMNH). All material collected by A. Mazurkiewicz and / or K. Pałka.

Region	**Locality**	**UTM**	**Habitat**	**Host**	**Stage**	**Date**	**reared**
Lublin Upland	Brzeźno village	FB96	xerothermic rail-way embankment	*Cru*	old galls	8.v.2004	
	Brzeźno res.	FB87	edge of calcareous peat-bog	*Cru*	larvae	5.x.2002	3♂, 3♀, 5 M
					old galls	28.v.2004	
	Czumów	GB03	grassland on loess	*Cru.*	galls	15.x.2001	
	Gródek	GB03	grassland on loess	*Ca*	galls	11.xi.2004	
	Podzamcze res.	FB05	grassland on limestone rocks	*Cru*, *LN*	galls	7.x.2001	
				Cru	larvae	5.x.2002	2♀, 1 M
					1♂, 1♀	24-28.v.2004	
	Rogów res.	FB73	grassland on limestone rocks		1♂, 1♀	25.v.2004	
	Skarpa Dobrska res.	EB68	grassland on loess		1♂	12.vi.1997	
				Cru, *LN*	galls	7.x.2001	
	Skarpa Dobużańska res.	FB90	grassland on loess	*Cru*	galls	15.x.2001	
	Stawska Góra res.	FB67	grassland on limestone rocks	*LN*	larvae	6.x.2001	2♂, 2♀
					larvae	3.x.2002	1♂, 21 M*
					larvae	10.x.2002	2♂, 5 M
	Tarnogóra	FB44	grassland on loess	*Cru*	galls	8.x.2000	
	Zalesie Kraszeńskie	FB57	xerothermic rail-way emb.	*Cru*	old galls	13.v.2004	
Małopolska Upland	Biała Góra res.	DA28	grassland on limestone rocks	*Cru*	galls	3.xi.2001	
	Biedrzychów	EB54	grassland on loess	*LN*	galls	2.x.2001	
	Góry Pieprzowe res.	EB51	grassland on loess		1♂	29.v.1995	
					2♂	2.vi.2001	
				Cru	larvae	3.x.2002	1♂, 1♀, 1 Chr, 6 M*
	Pińczów	DB60	grassland on gypsum	*LN*	galls	4.xi.2001	
					galls	10.x.2004	
	Wały res.	DA47	grassland on limestone rocks	*Cru*	galls	3.xi.2001	
Podlasie	Ciesacin res.	FB49	neutral grassland on sand on the edge of peat-bog	*Cru*	old galls	9.v.2004	
	Dobrowoda	FD62	grassland on gravel	*Cra*	galls	2.x.2002	*
	Drohiczyn	FD10	grassland on gravel	*Cru*	galls	2.x.2002	*
	Grzybowce	FD89	grassland on gravel	*Cru*	galls	9.x.2004	
	Mielnik – Przedmieście	FC49	grassland on gravel	*Cru*	galls	7.x.2001	
	Osłowo	FC39	grassland on gravel	*Cru*	galls	2.x.2002	9 M*
	Stare Stulno	FB89	neutral grassland on sand	*Cru*	galls	6.x.2001	
	Witowo, in Białowieża Primeval Forest	FD63	grassland on gravel	*Cru*	galls	2.x.2002	*
	Zagórze	FC39	grassland on gravel	*Cru*	galls	7.x.2001	
Roztocze	Biała Góra	FA79	grassland on limestone rocks	*Cru*, *LN*	galls	15.x.2001	
	Kąty II	FB51	grassland on limestone rocks	*Cru*, *LN*	galls	8.x.2000	
	Korhynie	FA88	grassland on limestone rocks	*Cru*, *LN*	galls	14.x.2001	
					galls	3.x.2002	4 M*
	Machnów	FA88	grassland on limestone rocks	*Cru*, *LN*	galls	20.x.1998	
					galls	25.ix.2004	
	Radruż	FA66	grassland on limestone rocks	*Cru*	larva	24.ix.2004	
Sandomierz Lowland	Nowa Dęba	EA58	neutral grassland on sand		1♂	3.vi.1998	
				Cru	galls	2.x.2001	
Przemyśl Hills	Złota Góra	FA31	grassland on gravel	*Cru*	galls	1.x.2001	

Tab. 2. Records of *Trifurcula pallidella*, except for Poland. The countries are indicated by their ISO codes, and some provinces abbreviated. Hostplants: *Ca* = *Chamaecytisus austriacus*, *Ch* = *C. hirsutus*, *Cr* = *C. ratisbonensis*, *Ln*= *Lembotropis nigricans*. Abbreviations: AZL = A. & Z. Laštůvka, EvN = E. van Nieukerken. Collection codons follow Evenhuis & Samuelson (2004). Reliability: ! after collectioncodon: material seen by EvN; ? not impossible, fits in distribution and biology, but confirmation required, ?? questionable (but not completely rejected). The remaining literature references are either reliable (genitalia check, recent authors, galls or circumstantial evidence) or at least likely records.

Key to sources: 1. Anikin 2001, 2. Baudyš 1925, 3. Baudyš 1931, 4. Baudyš 1947, 5. Burmann & Huemer 1998, 6. Caradja 1899, 7. Caradja 1901, 8. Černik 1942, 9. Curó 1883, 10. Czekelius 1924, 11. Hartig 1964, 12. Hauder 1912, 13. Hauder 1924, 14. Herrich-Schäffer 1847-1855, 15. Hrubý 1964, 16. Issekutz 1972, 17. Kasy 1985, 18. Klimesch 1949, 19. Klimesch 1961, 20. Klimesch 1968, 21. Klimesch 1990, 22. Laštůvka 1994, 23. Z. & A. Laštůvka 1994, 24. A. & Z. Laštůvka in litt., 25. Mann 1862, 26. Mann 1866, 27. Mann 1869, 28. Mann 1885, 29. Mariani 1938, 30. Mariani 1943, 31. Müller-Rutz 1922, 32. Nickerl 1908, 33. van Nieukerken & Johansson 1986, 34. van Nieukerken et al. 2004, 35. Pável & Uhryk 1896, 36. Prohaska & Hoffmann 1929, 37. Pröse & Segerer 1999, 38. Puplesis 1994, 39. Rebel 1899, 40. Schmid 1886, 41. Skala 1933, 42. Szőcs 1965, 43. Tokár et al. 1999, 44. Toll 1936, 45. Toll 1938, 46. Vorbrodt 1932, 47. Zeller 1850, 48. Zimmermann 1944b, 49. Zimmermann 1944a.

Country, Locality		**collector**	**stage, host**	**Source**
AT: BU	Bruck an der Leitha, Spitalberg	Preissecker	1♂	19, 49, NMW!
	Rechnitz, Donatikapella	Koschabek	1♂	16, 19
	Schieferberg, Leithagebirge	Kasy	1♂	33, NMW!
AT: KÄ	Villach	Preissecker	1♀	NHMB!
AT: NÖ	Fürbachwiesen, Gramatneusiedl	Kasy	4♂	17, 33, NMW!, RMNH!
	Hundsheimer Berg	Kasy	1♂	33, NMW!
	Jauerling	Preissecker		49
	Mödling [Goldene Stiege]		1♂	HNHM!
	Oberweiden	Preissecker		49
	Ostrong [Klimesch Haide]	Preissecker	1♂	21, 49, NMW!
	Pfaffstätten		1♀	HNHM!
	Stein a. D., Goldburg	Preissecker	1♂	49, NMW!
	Ysper	Preissecker	1♂	49, NMW!
AT: OÖ	Berg (Alpenvorland)	Wolfschläger		12, 21, 41
	Bergham	Wolfschläger		13, 41
	Diessenleiten	Hauder		13, 21, 41
	Ebelsberg (Alpenvorland)	Klimesch	[1♀!]	21, ZSM!
	Koglerau, Waldblösse	Knitschke	1♂	12, 21, 41, NMW!
	Linz, Linz kgl. [Koglerau]	Hauder	3♂	NHMB!, ZFMK!
	Linz-Uhrfahrwänd	Klimesch	[1♂!]	18, 21, ZSM!
AT: ST	Bruck a. Mur	Klimesch		19
	Graz; Graz, Plabutsch		9♂	33, 36, HNHM!, NHMB!, NHRS!, NMW!
	Premstätten	Prohaska	1♂	36, HNHM!
	Weiz	Knitschke	2♂	NMW!
AT: WI	Wien	Mann	4♂	14, 33, MNHN (LT)!, BMNH!
	Laaerberger Remisen	Mann		28, 49
	Mauer	Mann	1♀	19, 28, 49, NMW!
	Rodaun	Mann		19, 28, 49
	Tivoli	Mann		28, 49
	Wien, Dornbach		1♂	NMW!
CH	Ticino: Maroggia	Krüger	1♂	31, 46, NHMB!
CZ:Boh	Praha (Prag-Krtsch)	Nickerl		23, 32, 48

Country, Locality		**collector**	**stage, host**	**Source**
CZ:Mor.	Brno		gall, *Ln*	2
	Bulhary	AZL	larvae, *Ca*	22, 23
	Čelechovice na Hané	AZL		23, AZL!
	Dětkovice	AZL	15♂	23, RMNH!
	Dolní Dunajovice	AZL	larvae, *Ca*	23
	Hrušovany nad Jevišovkou	AZL	larvae, *Ca*	23
	Kvasice, Kvasická skála rock	Zavřel	gall, *Cr*	4
	Mikulov, Stráně u Sedlece	Picbauer, AZL	gall, *Ca*	4, 22,
	Mikulov, Pavlovské vrchy, Stolová h.	EvN	gall *Ca*	RMNH!
	Myslejovice	AZL	1♂	23, AZL!
	Olomouc, Neboteiner Berg	Černik	*Cr, Ln*	8
	Pouzdřany	Picbauer	gall, *Ln*	2
	Tuřany		gall, *Ln*	2
	Vicov	AZL	1♂	23
	Vranovice	AZL, EvN	7♂, 2♀, e.l. *Cr*	23, RMNH!
DE: BA	Grafenwöhr	Klimesch	1♂	ZSM!
	Kelheim Donau: Auf der Brand	E. Jäckh	1♂	USNM!
	Regensburg [Tegernheimerberge]		1♂	14, 37, 40, ETHZ!
FR– 2A	St. Lucia di Porto Vecchio	Liška	1♂	24
FR- 2B	15 km S. Bastia	Karsholt	1♂	24, ZMUC
GR–CR	Irakleio: Potamies	Johansson	2♂	RMNH!, Johansson!
	Irakleio: Stalis, Chersonisos	Bengtsson	2♂	Bengtsson!
	Rethymno: Plakias	Johansson	1♂	Johansson!
	Rethymno	Johansson	1§	Johansson!
GR	Fthiotis: Delfoi	Selling	1♂, 1♀	ZMUC!
	Ioannina: Asprángeli	AZL	2♂	24
	Lakonia: 5 km S Monemvasia	Skule,Christ.	1♂, 1♀	33, ZMUC!
	Lakonia: 7 km SW Monemvasia	Skule	1♂	33, ZMUC!
	Messinia: Messini	Horak	1♂	33, ZMUC!
HR	Josipdol			35?
	Rijeka (Fiume) (Istria)			30, 35?
	Dalmatia [no detail]			27?
HU	Budakeszi, Hársbokorhegy			42
	Nadap	Gozmany	1♂	42, HNHM!
	Nyír, Kecskemét	Klimesch	1♂	ZSM!
IT	Bolzano	Hedemann		11, 30, 39
	Bolzano: Renon: Collalbo	Hartig	1♂	11
	Catanzaro: Sta Catarina dello Ionio	AZL	1♀	24
	Imperia: Pieve d.T., Monesi	Liška	2♂	24
	Pisa	Mann		9, 14, 30, 47
	Trento: Pietramurata nei boschi	Jäckh	1♂	photograph in RMNH! [USNM]
	Verona: Mte Baldo, Ferrara + Pai	Burmann		5
IT-SIC	Messina: Francavilla di Sicilia	AZL	1♀	24
	Palermo: Castelbuono	AZL	1♂	24
	Palermitano (Sicilia)	Mann		9, 30
	Palermo: Vallecorta			29
	Palermo: San Martino delle Scale	Klimesch	3♂, 1♀	ZSM!
MK	Drenovo-Kav.	Klimesch		20
RO	Sibiu (as Hermannstadt)	Prall		10?
	Tulcea (as Tultscha)	Mann		6, 7?, 26
RU	Saratov	Anikin		1, 38
	Ul'yanovsk: Srednikovo, Povolzhye	Zolotuhin	1♂	34, coll. Zolotuhin!
SI	Carniola	Mann		9?
SK	Čebovce	AZL	2♂	23, AZL!
	Kočovce (Kocsócz)			15, 23?, 35
	Nové Mesto nad Váhom	Patočka		15, 23
	Plešivec	AZL, Patočka	1♂, *Ch*	23, 43
	Plešivec, Slov. Kras.: Hôrka	EvN	2♂, 2♀ e.l., *Ch*	RMNH!
	Velký Šariš, Prešov	Suza	gall, *Ca*	3
	Zádiel, Slovensky Kras	AZL, EvN	3♂, 1♀, el *Ln*	23, AZL!, RMNH!
TR	Bursa (Brussa)	Mann		25??
UA	Borshchiv area, S: Babuchow	Toll		44, 45
	Zalishchyky area: Obizowa	Toll		44, 45

The old record from Turkey (Mann 1862) is questionable: in Turkey occurs also a large pale species of *Trifurcula (Glaucolepis)*, which could easily be confused, but the occurrence of *T. pallidella* in Turkey is also to be expected.

The record of *T. pallidella* in September by Schmid (1886) is probably a misidentification for *T. beirnei*, likewise the August record from Macedonia (Klimesch 1968) is not accepted, but in both cases earlier records in the same area are considered as possibly correct *pallidella*. The record from 'Alpi Marittimi' (Mariani 1943) may refer to the incorrect record from the French department Alpes Maritimes (Cannes), but the recent record from Mónesi in the Alpi Marittimi very close to the French border also confirms its occurrence here in Italy. This also makes it more likely that real *T. pallidella* can after all be found in the French Department Alpes Maritimes.

In summary, *T. pallidella* is distributed from Southeast Germany (Bayern), east into Bohemia, Moravia, Slovakia, adjacent SE Poland, much of Austria, both along the Danube and East and South of the Alps, extending through the Balkans (with very few verified records) to southern Greece (Peloponnesus) and Crete, eastwards through Ukraine and Russia to the Volga, and one questionable record from Turkey. To the West it occurs in northern Italy almost reaching France, just extending into Switzerland (Ticino), and throughout Italy to Sicily and Corsica.

Habitats. In Poland and Slovakia the species was found in warm and dry grasslands or open woodland, often on calcareous soils, but also on sand or gravel (Figs. 1, 2, 4, Tab. 1). In one case (Brzeźno reserve, Fig. 3) it was found in a relatively wet habitat on the edge of a calcareous bog. Elsewhere in Europe it occurs in a variety of habitats, although usually on relatively warm places: often sunny slopes in river valleys, such as that of the Danube in Germany, Austria and Hungary. The hosts are frequently associated with *Quercus pubescens* woodland. The localities in Corsica, Greece and Crete are Mediterranean shrubland (garrigue, maquis or phrygana), often close to the sea. The altitudinal range is from sea level to 1000 m, with one record at 1600 m in Italy (Imperia, Monesi, Alpi Marittimi).

In 2001 and 2002 the species was extremely abundant in Poland, and larvae could be found in large numbers in most places. In contrast to that, in October 2004 almost no larvae or galls could be found in several of the same localities. Most localities in Central Europe are in Nature reserves, and the species may be vulnerable to increasing pressure by agricultural development and manure.

Discussion

Distribution and hostplant relationships. *Trifurcula pallidella* occurs commonly in many parts of the distribution area of its presumed hosts and is much more common than previously assumed (van Nieukerken & Johansson 1986). However, it has as yet not been found in the more western part of the distribution area of species of *Chamaecytisus*, e.g. France, parts of Germany and Spain. On the other hand, the distribution of *T. pallidella* cannot be explained completely by the distribution of the known hosts in the southern part of its range: no species of *Lembotropis, Chamaecytisus* or *Cytisus* sect. *Corothamnus* are known from Corsica or Sicily, and the relatively common occurrence of *T. pallidella* in southern Greece and Crete, contrasts with the sparse occurrence of just a few species of *Chamaecytisus*. In fact in this part of Greece and Crete only three species of brooms are frequent: *Calicotome villosa* (Poiret) Link, *Spartium junceum* L. and *Genista acanthoclada* DC. (Turland *et al.* 1993, EvN, personal observation in Peloponnesus).

Recent studies on the molecular phylogeny of the Genisteae (Cubas *et al.* 2002) support at least two large monophyletic clades: a *Genista* group and a *Cytisus* group. Käss & Wink (1995; 1997) find support for a division of the *Cytisus* groups in two clades using rbcL sequences and Neighbour Joining, in which *Chamaecytisus* is polyphyletic and dispersed over both clades, but all hostplants of *T. pallidella* in the analysis, group together with *Cytisus multiflorus*, *C. arboreus* and *Calicotome villosa*. However, in the ITS sequence and in MP analyses of both genes (Käss & Wink 1997), a monophyletic *Cytisus* group including *Calicotome* is supported. These authors therefore suggest to synonymise the genera *Lembotropis, Chamaecytisus* and *Calicotome* with *Cytisus*. Combining these results with the previous observations leads to the hypothesis that in the Mediterranean region *Calicotome* is a very likely alternative hostplant for *T. pallidella*, and that *T. pallidella* is specialised on a number of species (but not all) within the *Cytisus* clade.

There is an interesting parallel with the *Trifurcula immundella* species complex: this is a group of very closely related species, which feed on about the same hosts as *T. pallidella*, but the species in this complex are almost strictly monophagous: each feeds on only one or a few related hosts: *T. immundella* feeds on *Cytisus scoparius* (L.) Link, *T. moravica* Z. & A. Laštůvka, 1994 on *Lembotropis nigricans, T. corothamni* Z. & A. Laštůvka, 1994 on *C. procumbens*, *T. chamaecytisi* on *Chamaecytisus* and *T. calycotomella* A. & Z. & Laštůvka, 1997 on *Calicotome* spp. (Z. & A. Laštůvka 1994): all feeding on the *Cytisus* group and these species – apart from *T. immundella* – have combined the same host range as *T. pallidella*.

Galling. *Trifurcula pallidella* is the only species of the genus causing galls, the other species of the subgenus *Trifurcula* exclusively making stem-mines (van Nieukerken 1990; Z. & A. Laštůvka 1994; A. & Z. Laštůvka 1997), and most representatives of the other subgenera (*Levarchama* and *Glaucolepis*) make leafmines, a few *Glaucolepis* also stem-mines. The galls of *T. pallidella* in a way resemble the stem-mines, but the larva seems to feed in deeper tissue than is usual for *Trifurcula* (s. str.) species. It places *T. pallidella* in a rather isolated position in the genus, and also morphologically it is not very close to any other species. There is no apparent explanation why this species changed the stemmining habit into galling: on the same hostplants stemmining species also occur as discussed above, so the plant itself cannot be the reason. The larva does not show special adaptations to the galling habit, it is only larger than most other Nepticulidae larvae, and the mandibular cusps are relatively strongly developed.

Galling has originated several times independently in the Nepticulidae: there are at least three other examples. The North American type species of the genus *Ectoedemia* (which means as much as an external swelling), *Ectoedemia populella* Busck, 1907 is causing globular galls in the petiole of *Populus* (Busck 1907). Related species in the *populella* species group also cause thickened petioles by their feeding habit, but these are not considered real galls. Most likely *E. populella* evolved from a petiole mining species. *Ectoedemia (Zimmermannia) castaneae* Busck, 1913, another North-American species, makes galls on bark of *Castanea* (Busck 1913), and probably evolved from barkmining species. Further *Ectoedemia (Fomoria) nigrifasciata* (Walsingham, 1908) from the Canary Islands makes a combined gall and mine in the Apocynaceae *Periploca laevigata* Ait. (Klimesch 1972); its closest relatives are leafmining on *Euphorbia*.

For two species of *Trifurcula* the larval way of feeding is still unknown: *T. beirnei* and *T. squamatella* Stainton, 1849. Both are relatively large species (the largest in the genus), associated with resp. *Genista* species and *Cytisus scoparius*. It is well worth considering the possibility that they are also gall makers, when searching for their larvae.

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Lomaspilis bithynica Wehrli, 1954 stat. rev., a distinct species new for Europe (Geometridae)

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Abstract. *Lomaspilis bithynica* Wehrli, 1954 formerly treated as a subspecies of *L. opis* (Butler, 1878) is recognized as a distinct species after an examination of the holotype and additional material. A differential diagnosis is given to distinguish the species from the other two Palaearctic members of genus *Lomaspilis* Hübner, [1825]. The external and genital features of the three species are figured. *L. bithynica* has been recorded from the Turkish provinces of Bolu, Trabzon, Çankiri, Erzurum, Erzincan, Artvin, Rize, and Kars. It is recorded here for the first time from Europe based on specimens collected recently in central Greece. Data on bionomics are also given.

Zusammenfassung. *Lomaspilis bithynica* Wehrli, 1954 stat. rev., die früher als Unterart von *L. opis* (Butler, 1878) galt, wird nach Untersuchung des Holotypus und weiteren Materials in den Artstatus erhoben. Eine detaillierte Diagnose gestattet es, die Art von den beiden anderen palaearktischen Arten der Gattung *Lomaspilis* Hübner, [1825] zu unterscheiden. Ihre äußeren Unterscheidungsmerkmale sowie die der Genitalapparaturen werden abgebildet. Nach unserer Kenntnis wurde *L. bithynica* in den türkischen Provinzen Bolu, Trabzon, Cankiri, Erzurum, Erzincan, Artvin, Rize und Kars gefunden. Die Art wurde neuerdings auch in Zentral-Griechenland nachgewiesen, was einen Erstnachweis für Europa darstellt. Erstmalig werden auch Daten zur Lebensweise von *L. bithynica* publiziert.

Key words. Lepidoptera, Geometridae, *Lomaspilis*, *bithynica*, Turkey, Greece, Europe, species status, morphology, distribution, host plant.

Introduction

Scoble (1999) lists only two species in the genus *Lomaspilis* Hübner, [1825]: *L. marginata* (Linnaeus, 1758) and *L. opis* (Butler, 1878), the latter represented by four subspecies: the nominotypical *L. o. opis* from Japan, *L. o. amurensis* (Hedemann, 1881) from the Amur region, *L. o. nigrita* Heydemann, 1938 from Finland, and *L. o. bithynica* Riemis, 1992 from north-eastern Turkey (Prov. Erzurum). Viidalepp (1996) lists *L. amurensis* (Hedemann, 1881) as a subspecies of *marginata*.

L. opis bithynica Riemis, 1992 had been described as form "*bithynica*" of *Lomaspilis marginata* by Wehrli (in Seitz 1954). According to article 10.2 of the International Code of Zoological Nomenclature (1999), a form name is available if validly published before 1961. Because Wehrli's (1954) publication is valid, he correctly made *Lomaspilis opis bithynica* (cf. ICZN article 45.6) an available name in writing: "...Eine merkwürdige Form, vielleicht zu subsp. *opis* Btlr. ... gehörig, oder besondere Art oder Rasse, – form. *bithynica n.* (22 e) erhielt ich von Boli, Kleinasien (E. Pfeiffer) leider nur in einem ♀ Exemplar...". Riemis (1992) was not justified to redescribe this taxon as a new subspecies. Thus, *L. opis bithynica* Riemis, 1992 must be listed as a junior primary homonym of *L. opis bithynica* Wehrli, 1954.

During several trips to north and north-eastern Turkey, the senior author found several specimens of *L. bithynica* looking identical to those figured by Wehrli (1954) and

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Riemis (1992). The first attempt to breed specimens of this *L. bithynica* population ex ovo on *Betula* spp., which are the only known host plants of *opis* (Skou 1984), was not successful. No larva fed on this plant and all died. In another experiment, *Salix* sp. and *Populus tremula* were additionally offered because *Salix* and *Populus* species are known to be the typical host plants of *L. marginata*, while *Quercus, Fagus, Betula,* and *Corylus* are also mentioned in the literature as occasional host plants (Bergmann 1955; Ebert et al. 2003). It was found that larvae of *L. bithynica* feed only on *Populus tremula*. These results were confirmed by other entomologists (T. Drechsel, B. Müller). *P. tremula* was common at all sites where *L. bithynica* was found. Consequently, we hypothesized that *L. bithynica* would not be a subspecies of *L. opis* Butler.

Comparative studies were done to answer this hypothesis. After detailed analysis of both male and female genitalia, we found that *L. opis bithynica* was not conspecific with *L. opis* or *L. marginata.* Consequently, we consider *L. bithynica* as a good species: *Lomaspilis bithynica* Wehrli, 1954 stat. rev. The key to solve this taxonomic problem was to apply the method of vesica eversion as improved by Sihvonen (2001). We also compared our material with the holotype of *L. bithynica* (Figs. 7–8) described and figured by Wehrli (1954) and the holotype of *L. opis bithynica* of Riemis (1992). East Palaearctic subspecies or forms of *L. opis* and *L. marginata* were not included in our studies.

Abbreviations

ZFMK	Zoologisches Forschungsinstitut und Museum Alexander Koenig, Bonn
ZMA	Zoological Museum Amsterdam
ZSM	Zoologische Staatssammlung, Munich

Material. *L. bithynica* Wehrli, 1954: Holotype ♀ with labels: 'Asia min.[or] s. | Bithynia | Boli <sic> 11.–20.vi.[19]34 | 800 m | E. Pfeiffer - München leg.' (on white paper printed in black); '*bithynica* Wehrli *Lomaspilis* Hb. | Holo ♀ Type (on red paper handwritten and printed in black), ZFMK. – *L. opis bithynica* Riemis, 1992: Holotype ♂ with labels: 'TURKIYE St.1703 <?> | Erzurum Rd.[Road] Erzu- | rum-Ispir, 10 km SW | Ovacik, 2300 m | 2.vii.1991 | W.De Prins, D. v. d. | Poorten, A.Riemis' (on white paper printed in black); 'HOLOTYPE | Lomaspilis | opis bithynica | det. A. Riemis, 1992' (on red paper printed in black), ZMA. – **Turkey**: 2♂, Prov. Erzurum, Kaçkar Daği, Yaylalar, alt. ca. 1900 m., 4./5.vii.1983, M.-C. et F. Aulombard et J. Plante leg., ZSM; 22♂, 8♀, Dog. Karadeniz Dağlari: Korga Daği, Umg. Köprüköy bei Ispir, 1600–2000 m, 3.–8.vi.2000, Gelbrecht, Drechsel, Busse & Schwabe leg., (7♂, 8♀, ex ovo cult., emerged: 20.iv.2001–12.v.2001 and 7.x.2001 and iv.2002), coll. Gelbrecht et coll. Malkiewicz; 2♂, 1♀, same locality, 1600 m, 23.vii.2001, leg. et coll. Löbel; 1♂, same locality, 1600 m, 22.vi.2002, Gelbrecht & Schwabe leg., coll. Gelbrecht; 2 ex., same locality, 1600 m, 06., 24.vi.2003, leg. et coll. Müller; 1 ex., 9 km S Ispir im Tal des Çoruh, 1840 m, 23.vi.2001, leg. et coll. Ochse; 1♂, Kuzgun-Brj., Stausee, 2280 m, 22.vi.2003, leg. et coll. Müller. 1♂, Prov. Kars, Arastal, 15 km E Karakurt, 1400 m, 23.vii.1992, leg. et coll. Petersen; 1♂, Sarikames, 2000 m, 4.vi.2000, leg. et coll. Petersen. 1 ex., Prov. Artvin, Kaçkar Daği, ca. 1800 m, Yaylalar Umg., 17.vii.1995, leg. & coll. Noack; 2 ex., Kaçkar Daği / Bilek Daği, 7 km N Aksu, 1600 m, 16.vii.2001 leg. et coll. Ochse. Prov. Rize: 1♂, 1♀, Umg. Çamlik, 1500 m, 8.vi.2003, leg. et coll. Müller. 2♂, Prov. Trabzon, Ovit Daği, 5 km N Hotel Genesis b. Dereköy, 1200–1300 m, 29.v.2000, leg. Gelbrecht, Drechsel, Busse & Schwabe, coll. Gelbrecht. 1♀, Prov. Çankiri, Ilgaz Umgebung, 1400 m, 10.vi.–14.vi.1991, leg. et coll. Löbel; 1♀, Ilgaz Umgebung, 960 m, 16.vi.1992, leg. et coll. Petersen. **Greece**: 2♀, Aliakmon River, Ag.[ios] Georgios Grevena 600 m, 6.vi.1992, Müller et Kotitsa leg., ZSM.

L. opis nigrita: 3♂, 5♀, **Poland**, Mikaszówka, P.[uszcza] Augustowska, 1.–10.vii.1997, Malkiewicz leg.; 2♂, Gruszki, Puszcza Augustowska, 13.vi.1992, Kokot leg.; 1♂, Rygol, Puszcza Augustowska, 16.vi.1992, Kokot leg.; 1♂, Grudki, Puszcza Białowieska, 6.vi.2000, Kokot leg.; 2♂, 2♀, Puszcza Borecka, 1.–13.06.1994, Buszko leg.; 3♂, 2♀, Mostki, gm.[ina] Staszów, 6.vi.1990, Pałka leg.; all specimens in coll. Malkiewicz.

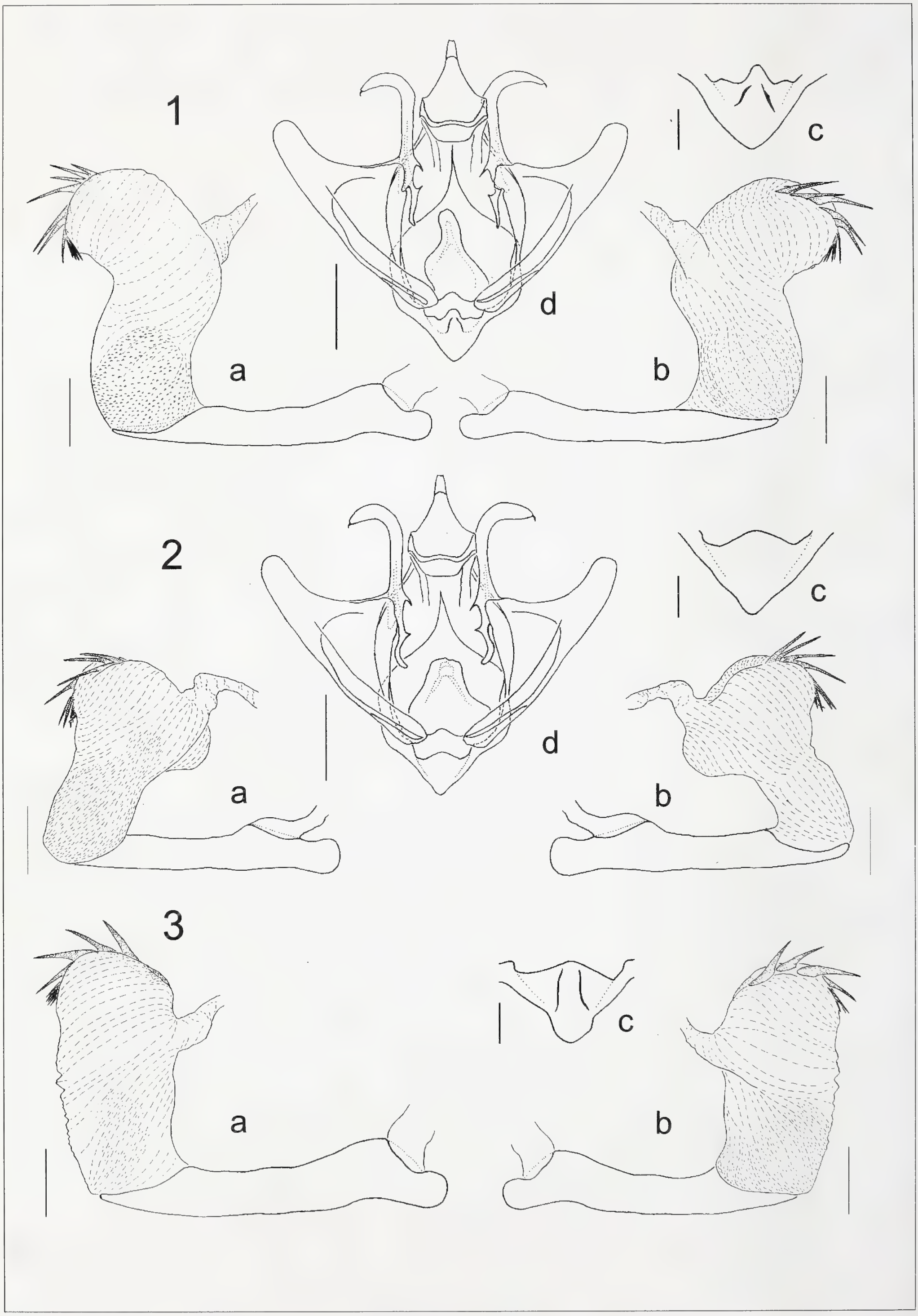
L. marginata: 3♂, 3♀, **Poland**, Szklarska Poręba G.[órna], 10.v.1990, 15.vi.1991, 20.vii.1991; 2♂, 2♀, Karpacz-Stanica, 22.vi.1990, 5.vi.1993; 1♂, Wrocław 14.vi.[19]84; 1♀, Czarny Dunajec, 15.vii.1993; all specimens leg. et coll. Malkiewicz; 1♂ Polska, Toruń, 10.v.1994, J. Buszko leg.; 1♂ Polska, DV25, Tatra Mts., 1100 m., Dolina Jaworzynka, 7.vii.2001, J. Buszko leg.; 1♀ Polska, Bory Stobrawskie, Dobrodzień, 11.v.1991, leg. A. Guziak; 1♀ Polska, distr. Żary, Pietrzyków, 11.v.1998, A. Kokot leg.

Lomaspilis bithynica Wehrli, 1954

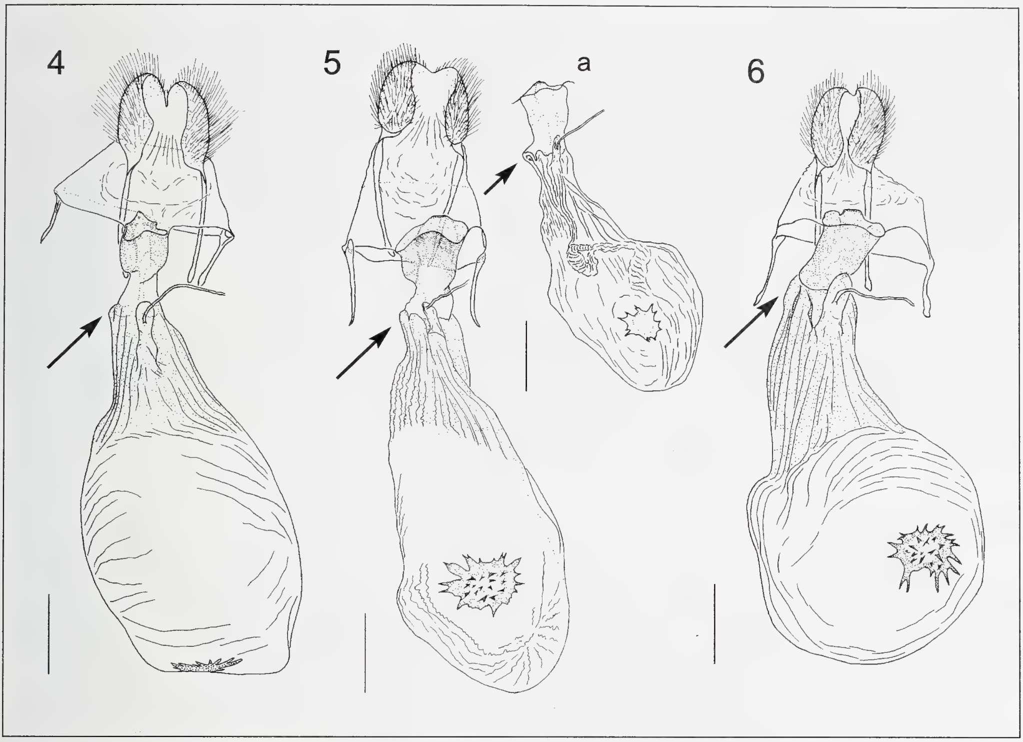
Diagnosis. External features. Forewing length: male 14.0–15.0 mm (average 14.5), female 11.5–13.0 mm (average 12.3) (most females were bred). Forewing of *L. opis nigrita* males approximately 2 mm shorter (12.5 mm), whereas *L. marginata* males about 1.2 mm shorter (13.3 mm). Females of all three species similar in forewing length. Pattern of fore- and hindwings generally as in other two *Lomaspilis* species; differences expressed in shades and shapes of spots. Basal and median spots black with bluish suffusion. Terminal band pure black. Ground colour white, apart from costa (in bred females sometimes yellowish). Basal spot trapezoid, slightly concave between Cu and An veins, not oval as in *L. opis* and not as elongate as in *L. marginata.* Black medial band distal at M2 and CuA2 with two deep constrictions; at CuA2 often interrupted (Figs. 13–15). In *L. opis*, the medial band is broader, the concave constrictions are not so deeply, but mostly it is interrupted at CuA2. Terminal black band medial concavity deepest and more angled on both fore- and hindwing. Shape and continuity of medial band of both wings and width of medial concavity in terminal black band variable. *L. opis* wing pattern with similar variability, but medial band rarely continuous. Most important variation found in *L. marginata,* for which medial band can be reduced to one costal spot on forewings and nothing on hindwings.

Male genitalia (Figs. 1–3). (*L. bithynica*: n=5; *L. opis nigrita*: n=10; *L. marginata*: n=6). Valva of *L. bithynica* distally slightly narrower than in *L. opis*, but almost uniform in shape in the three species. Basal process of costa hook-shaped, more sinuate and longer than that of *L. opis* and *L. marginata.* Medial part of costa curved abruptly, curved regularly in other two species. Saccus triangular without distinct pair of wrinkles in middle, but present in the two other species (Figs. 1c, 3c). Width of tip of costa variable in all species. Vesica pear-shaped: anteriorly narrow, medially becoming wider, posteriorly twice anterior width; anterior part covered with minute spines at one side; posterior end with one row of cornuti, attached opposite to ductus ejaculatorius; at base of ductus ejaculatorius, vesica forming a small globular diverticulum. The latter is absent in the other species in which the vesica is more simply built: elongate, cylindrical in *L. marginata* (Fig. 3) and kidney-shaped in *L. opis* (Fig. 1). Number, shape, and distribution of cornuti variable and not diagnostic (8–12 for *L. bithynica*, 12–15 for *L. opis*, 8–14 for *L. marginata*).

Female genitalia (Figs. 4–6). (*L. bithynica*: n=6 from Greece and Turkey; *L. opis nigrita*: n=9; *L. marginata*: n=6). Antrum cup-shaped, more strongly sclerotized posteriorly. Ostium comparatively wider than in *L. opis.* Colliculum large, strongly sclerotized; it is narrower in *L. opis* and only weakly developed in *L. marginata.* Bursa copulatrix pear-shaped in *L. opis* and *L. marginata*, but in *L. marginata* more spherical anteriorly. In *L. bithynica* bag-shaped, highly dependent on maturation stage.



Figs. 1–3. Male genitalia of *Lomaspilis* spp. **1.** *L. opis nigrita* from Poland. **2.** *L. bithynica* stat. rev. from Turkey. **3.** *L. marginata* from Poland. **a, b.** Aedeagus with everted vesica (viewed from both sides). **c.** Saccus enlarged. **d.** General view with aedeagus removed (scale bar 0.5 mm).

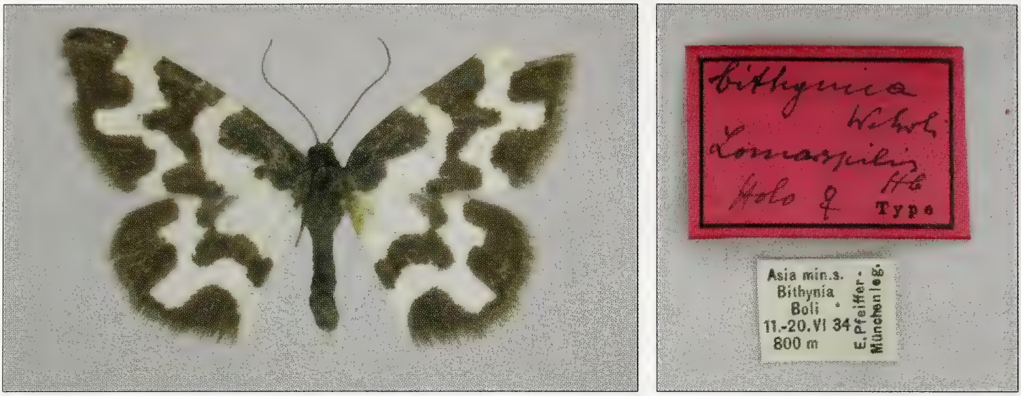


Figs. 4–6. Female genitalia of *Lomaspilis* spp., ventral view. **4.** *L. opis nigrita* from Poland. **5.** *L. bithynica* stat. rev. from Greece, Aliakmon River; **5a**. Bursa copulatrix of virgin female, not expanded from Turkey, Korga Daği, above Köprüköy near Ispir. **6**. *L. marginata* from Poland, Karkonosze Mts. (scale bars 0.5 mm).

Shape of asteroid signum strongly variable in all species; localized on ventral side of bursa in *L. bithynica* and *L. marginata*, but at bottom of bursa in *L. opis*.

Distribution. *L. bithynica* is known from many sites in northern and north-eastern Turkey and from one locality in Greece (Prov. Nomos Grevenon). This is the first record of this species for Europe. According to Ebert (pers. comm.) no specimens of the genus *Lomaspilis* are known from Iran. The distribution of *L. bithynica* is strongly isolated from that of *L. opis* which ranges from eastern Poland, eastern Slovakia and Finland through Russia and the East Palaearctic region (Malkiewicz & Sosiński 2000, Müller 1996, Skou 1984, Viidalepp 1996). *L. marginata* is a common species throughout most regions of Europe and its range extends to eastern Asia, southward to northern Turkey and the Caucasus.

Life history. Habitats of *L. bithynica* are deciduous forests with *Populus tremula*, the only known host plant, in mountains at an altitude of 600 m above sea-level in Greece and between 800–2,300 m a.s.l. in Turkey. This univoltine species flies from the end of May until the end of July. Under breeding conditions a few specimens of a second generation emerged in September and at the beginning of October. Adults were collected at light but also sometimes during the day like other *Lomaspilis* species.

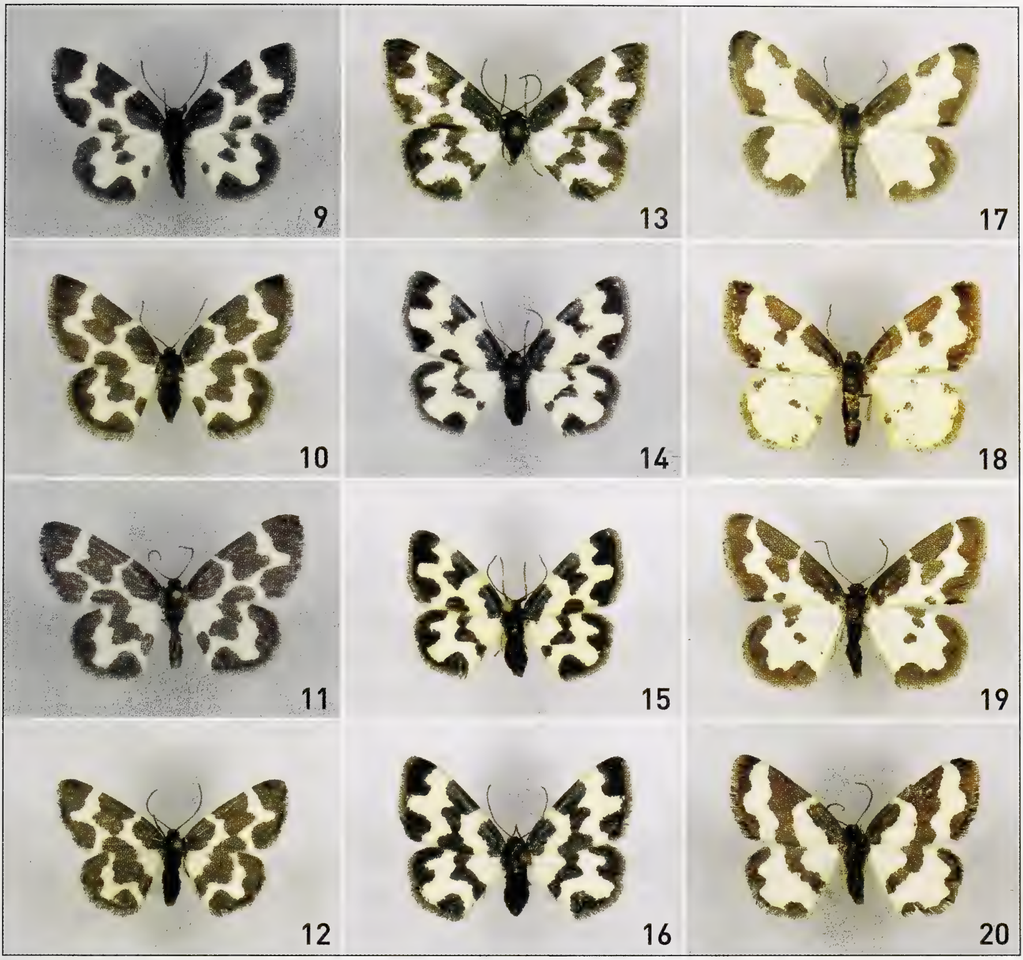


Figs. 7–8. Holotype of *Lomaspilis bithynica*, female (ZFMK).**7.** Specimen. **8.** Labels.

Discussion. Most authors of previous studies on the morphology and taxonomy of the genus *Lomaspilis* emphasized the poor or non-existent value of the male and female genitalia for determination at the species level (Wehrli 1954; Buszko & Bengtsson 1991; Riemis 1992). However, Heydemann (1936) recognized about 10 diagnostic characters in both sexes. According to our analysis only three of these are more or less useful: the shape of the saccus (and arrangement of wrinkles) in males, the shape of the bursa, and width of the ostium bursae in females. The other features listed by Heydemann are not suitable, particularly regarding the male's uncus, shape of the valva, the number and shape of the cornuti, and the shape of the signum in females. The last especially, repeated and illustrated by Riemis (1992), can be misleading because of wide intraspecific variability. The only reliable male character we could find is the form of the vesica. Another doubtful character regarded as diagnostic is the black colour of the dots and bands on the wings as well as on the head, thorax, and abdomen. In *L. bithynica* the black markings are not more black than those of *L. opis nigrita*, and both species are not always distinctive from *L. marginata* by the intensity of its black markings. There are some examples of *L. marginata* specimens that are more black than brown in collections and in the literature (Buszko & Bengtsson 1991). On the contrary, the pure white ground colour of the wings in *L. bithynica* seems to be diagnostic, at least for males.

Acknowledgements

The authors gratefully acknowledge Dr. D. Stüning, ZFMK, Bonn, for finding and taking a photograph of the holotype of *L. bithynica*, Dr. W. Hogenes, ZMA, Amsterdam, for the loan of type material, G. Ebert for information on the genus *Lomaspilis* in Iran, Dr. M. Nuss, Museum für Tierkunde Dresden, and Dr. W. Mey, Naturkundemuseum Berlin, for helpful comments on nomenclatural problems, Dr. A. Hausmann, München, for borrowing material from ZSM, Prof. J. Buszko, Torun and A. Kokot, Wrocław, for access to their collections, and T. Drechsel, Neubrandenburg, Dr. H. Löbel, Sondershausen, Dr. B. Müller, Berlin, D. Noack, Wildau, Dr. M. Ochse, Bad Dürkheim, M. Petersen, Darmstadt, for information on new records of *L. bithynica* and breeding experiments. We also thank two anonymous reviewers for improvement of the manuscript.



Figs. 9–20. Variability of wing pattern elements of *Lomaspilis* spp. **9–12.** *L. opis nigrita* from Poland: **9.** Male, Puszcza Borecka; **10–12.** Females, Mikaszówka, Płaska, Puszcza Augustowska. **13–16.** *L. bithynica* stat. rev. from Turkey: **13.** Male, **14–16.** Females, Korga Daği, above Köprüköy near Ispir. **17–20.** *L. marginata* from Poland: **17.** Male, Toruń; **18.** Female, Dobrodzień; **19.** male, Tatra Mts., Dolina Jaworzynka; **20.** Female, Pietrzyków.

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Leucoptera lathyrifoliella (Stainton, 1866) and *L. orobi* (Stainton, 1870): two distinct species (Lyonetiidae)

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Abstract. *Leucoptera lathyrifoliella* (Stainton, 1866) and *L. orobi* (Stainton, 1870) are considered distinct species on the basis of constant differences in the morphology of both male and female genitalia. No support was found for literature statements of differences in external appearance between the species. Likewise, the presumed differences in their host plants appear uncertain or erroneous, since both species exploit several host plant species in the plant genera *Vicia* and *Lathyrus*.

Key words. Lyonetiidae, *Leucoptera lathyrifoliella*, orobi, distinct species.

Introduction

Species of the genus *Leucoptera* Hübner, [1825] (Lyonetiidae) are very small moths with typically silky white or grey forewing ground colour and distinctive eye-spots at apex of the wing. The taxonomy of the West-Palaearctic species of the genus was recently revised by Mey (1994), who recognised twenty species to occur in the area.

Among the species, some uncertainty has occurred in the taxonomic status of *L. lathyrifoliella* (Stainton, 1866) and *L. orobi* (Stainton, 1870). Pierce & Metcalfe (1935) and Buszko (1981) illustrate the genitalia of these species. Their pictures, well in agreement with each other, display obvious differences between them. However, Mey (1994) considered them conspecific and accordingly synonymised *L. orobi* with *L lathyrifoliella*. Baraniak (1996) reports *L. lathyrifoliella* (including *L. orobi*) to occur in western, central and northern Europe. In Finland, both *L. lathyrifoliella* and *L. orobi* have been reported to occur. However, *L. orobi* was excluded from, e.g., the Finnish checklist (Varis et al. 1995) following Mey (1994). According to the literature, these species are identifiable by their wing pattern as well, and they are reported to have different host plants. *Lathyrus linifolius* (= *L. montanus*) is reported to be the host plant of *L. orobi*. The record of *L. tuberosus* as another host plant is considered a confusion due to plant nomenclature (Emmet 1985). *Lathyrus sylvestris* and *L. pannonicus* are listed as host plants of *L. lathyrifoliella* (Emmet 1985, 1988; Mey 1994).

The separation of these supposed taxa seems not possible using external appearance of adults. The wing pattern of both species varies more than mentioned in the literature, and differences suggested in the literature (e.g. hindwing fringe, cf. Emmet 1985) could not be verified after examination of over 50 specimens of both species. Moreover, both species have proven to exploit several host plants. Therefore, the host plant cannot be used as identification guide either. Yet, structures in both male and female genitalia possess features that constantly differ between the taxa *L. lathyrifoliella* and *L. orobi*. After examination of the genitalia of a considerable number of individuals

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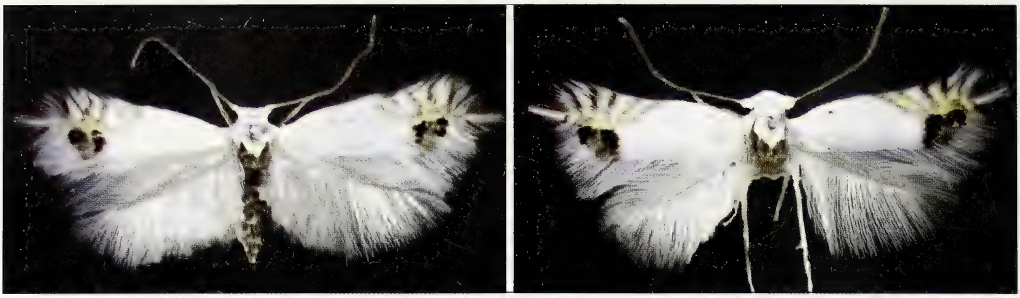


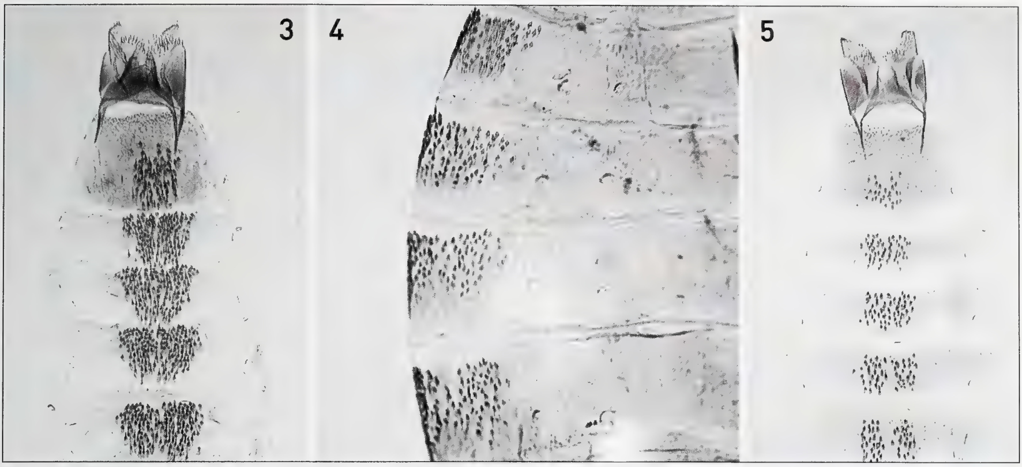
Figs. 1–2. Adults of *Leucoptera*. **1.** *L. orobi*. **2.** *L. lathyrifoliella*.

we suggest that *L. lathyrifoliella* and *L. orobi* are indeed distinct species, in agreement with Pierce & Metcalfe (1935) and Buszko (1981). In this paper we revise the taxonomy of *L. lathyrifoliella* and *L. orobi*, largely based on Finnish material. We provide diagnoses and illustrate the differentiating characters for these species.

The terminology follows Mey (1994). Material for the study was obtained from the following collections: BMNH (The Natural History Museum, London, U.K., K. Tuck), MNHB (Museum für Naturkunde, Humboldt-Universität Berlin, Germany, W. Mey.), MZH (Zoological Museum, Finnish Museum of Natural History, University of Helsinki, Finland, L. Kaila), NMS (National Museum of Scotland, Edinburgh, Scotland, K. P. Bland) and the following private collections: Jari Junnilainen (Vantaa, Finland), Marko & Tomi Mutanen (Oulu, Finland), Kari Nupponen (Espoo, Finland) and Kari Vaalamo (Espoo, Finland).

Leucoptera orobi (Stainton, 1870) Figs. 1, 3, 4, 6, 8, 9

Material. Lectotype ♀ slide of *Cemiostoma orobi* Stainton labelled: *Cemiostoma / orobi* STAINTON / lectotype / Scarboro / Mey 13/02 III. 02; BMNH Microlep. / 30226 / Euparal. BMNH, here designated. **Estonia:** Kogula, 20.vi.1994 1♀ J. Junnilainen leg. (slide BW 4891); Paldiski 2.vi.2000 1♂ J. Junnilainen leg. (slide BW 4292); **Finland:** Al: Kökar, Hamnö, 27.vi.1948 1♀ A. Nordman leg. (slide BW 4863), e. p. 1948 2♂ A. Nordman leg. (slides BW 4854, 4855); Kökar 666:15 24.vi.1991 1♂ J. Junnilainen leg. (slide BW 4890); EK: Virolahti 671:53 28.vi.1999 1♂ J.-P. Kaitila leg. (slide BW 4913); EH: Hattula 677:35, 9.vi.1988 1♂ Nupponen leg. (slide BW 4851); Somero 672:30 6.vi.2000 2♂, 1♀ T. Mutanen leg. (slides BW 4833, 4834 (♀), BW 4841 (♂)); 5.vi.2000, 1♂, 1♀ T. Mutanen leg. (slides BW 4835 (♀), BW 4840 (♂)), 13.vi.2000 1♀ T. Mutanen leg. (slide BW 4836); ES: Imatra 678:59, 14.vi.1998 1♂, 2♀ M. Mutanen leg., slides BW 4837 (♂), BW 4838 (♀) BW 4839 (♀); Imatra 678:59, 10–12.vi.2000 1♂, 3♀ B. Wikström leg. (slides BW 4843 (♀), BW 4844 (♀), BW 4845 (♀), BW 4846 (♂)); Joutseno 667:58 4.vi.1989 1♂ T. & K. Nupponen leg. (slide BW 4366), 10.vi.2000 1♂ B. Wikström leg. (slide BW 4818); **Latvia:** Skaune 18.v.1998 1♂ J. Junnilainen leg. (slide BW 4893); **United Kingdom:** Ballyvaghan Clare, 5.vi.1971 1♂ E. C. Pelham-Clinton leg., E.C.P-C.No. 27438 (ex larva *Lathyrus*), NMSZ 1989.035, (slide BW 4856, Coll. NMS); Ventnor, Isle of Wight 5.vi.1971 1♂ E. C. Pelham-Clinton leg., E.C.P-C.No.27439, ex larva *Lathyrus sylvestris*, leg. 1968, slide BW 4857; Aviemore, Inv. 24.vi.1969 1♀ E. C. Pelham-Clinton leg., E.C.P-C.No.25949, (ex larva *Lathyrus*), slide BW 4858, Coll. NMS.



Figs. 3–5. Abdomina of *Leucoptera*, showing the seta vestiture of terga. **3.** *L. orobi*. **4.** Lectotype of *L. orobi*. **5.** *L. lathyrifoliella*.

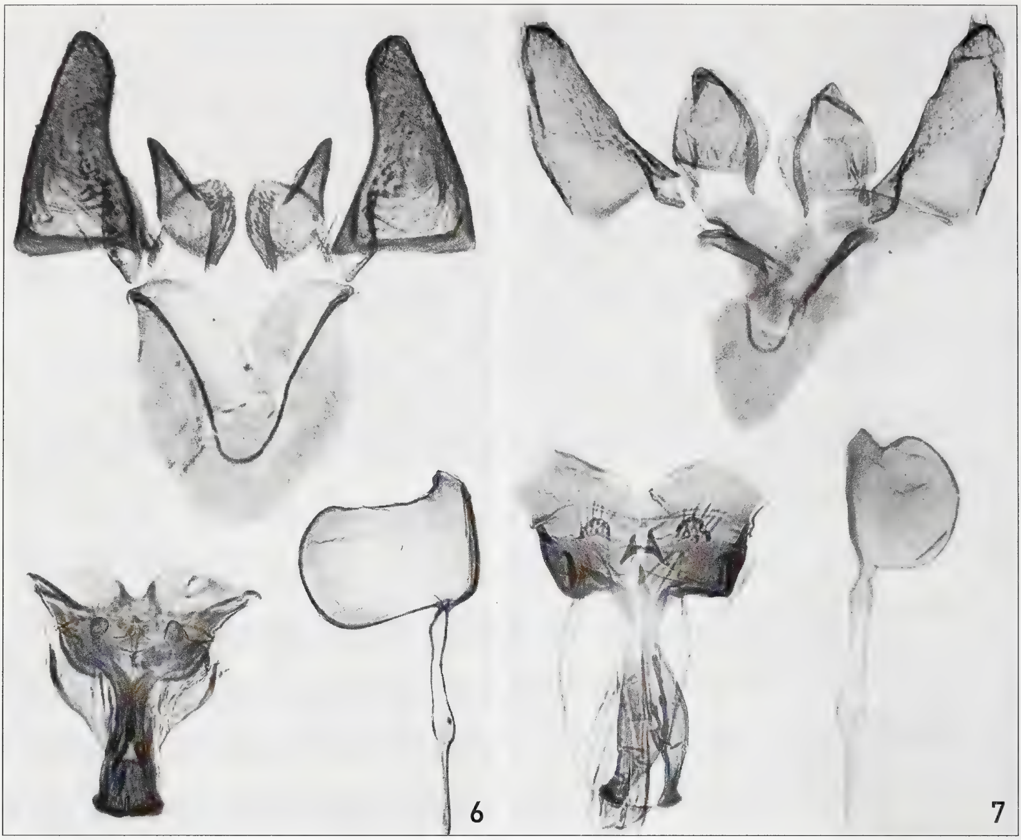
Diagnosis. For habitus see Fig. 1. Abdominal terga densely covered by stout setae (Fig. 3). Male genitalia (Fig. 6). Valva rounded at base, forming an acute-tipped extension apically, evenly tapered. Pleurallobus basally dilated, distolaterally with equally long triangular lobe. Phallotheca basally with large dilation (bulbus ejaculatorius), about 1.5 times broader than long. The semicircular nodose extension of gnathos and tegumen typical to *L. lathyrifoliella* vestigial.

Female genitalia (Fig. 8). Sternum 8 broad triangular, ostium bursae about half the width of sternum 8 since sternum 8 surrounds it by broadly sclerotised wall.

Life history. Emmet (1985) reports *Lathyrus linifolius* to be the host plant of *L. orobi*. In Finland it has also been found in sites where no *Lathyrus* grows, only *Vicia cracca* and *V. sepium* present as possible host plants. However, to our knowledge it has never been reared from either of these plant species. According to Emmet (1988) *L. orobi* has two generations in England. The first brood hatches from hibernated pupae during May, and the second brood flies during July. According to Emmet (1985) *L. orobi* occasionally develops a scarce second brood during July although a majority of pupae have a diapause and hibernate two or even more times. Collecting experience in Finland seems to support the view that *L. orobi* is single-brooded in Finland, the flying period from early to late June. No records from July are available.

Distribution. Finland, Estonia, Ireland, Latvia, U. K. (Scotland).

Remarks. The lectotype specimen possesses the diagnostic features of *L. orobi*, i. e. the shape of ostium bursae (Fig. 6) and the dense seta vestiture in abdominal terga (cf. Fig. 5). The latter character is, however, somewhat variable and should not alone be used in species identification.



Figs. 6–7. Male genitalia of *Leucoptera* (for each fig., top: valvae, vinculum, pleurallobus; bottom left: gnathos and tegumen; bottom right: aedeagus). **6.** *L. orobi*. **7.** *L. lathyrifoliella*.

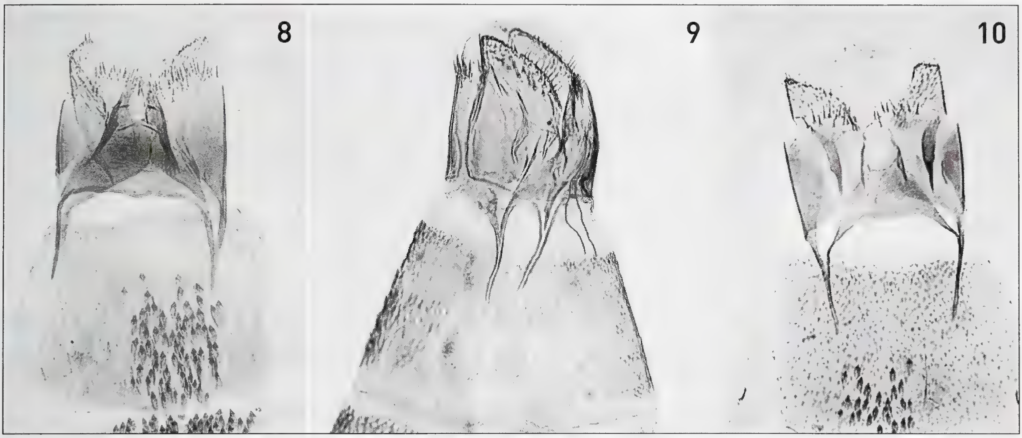
Leucoptera lathyrifoliella (Stainton, 1866) Figs. 2, 5, 7, 10

Material. **England**: Three syntypes and one pin without specimen: South Devon, Teignemouth, *Lathyrus*, e.l. 30.7.1861, Coll. Jordan. BMNH; South Devon, Branscombe, 1♀ 2.vi.1982 J. Langmaid leg. & Coll., 1♂, 2♀ e.l. ex *Lathyrus pratensis*, larvae 9.viii.1987, emg. 7.–12.v.1988 J. Langmaid leg. & Coll. **Finland:** V: Pargas (no date) 1♂, 2♀ A. Nordman leg. (slides BW 3239, 4847 (♀), 4860 (♂)) (ZMH); Turku 670:23.vi.1998 1♂, 1♀ e. l., T. Mutanen leg. (slides BW 4830 (♀), BW 4831 (♂)), vi.2000 2♀ e. l., T. Mutanen leg. (slides BW 4832, 4861); 20.vii.1992 1♂, 2♀ T. & K. Nupponen leg. (slides BW 4848, 4849 (♀), 4850 (♂); Vihti, Nummela, 669:35 1♂ e.l. 1995 B. Wikström leg. (slide BW 4885); U: Inkoo 666:32 10.vi.1996 1♂ B. Wikström leg. (slide BW 4842), 1.vi.1993 1♂ B. Wikström leg. (slide BW 3988). **Germany**: Kyffhäuser 2♂, ex *Latyhrus sylvaticus* (Zool. Mus. Berlin).

Diagnosis. For habitus see Fig. 2. Abdominal terga usually sparsely covered by stout setae (cf. Fig. 8 and remarks below).

Male genitalia (Fig. 7). Valva evenly tapered to acute tip. Pleurallobus broadest medially, apically gradually tapered. Bulbus ejaculatorius about as broad as long. Gnathos and tegumen with nodose semicircular extension.

Female genitalia (Fig. 10). Sternum 8 anteriorly broad, lateroposteriorly inward curved, thus being posteriorly narrow cylindrical. Ostium bursae as broad as the posterior part of sternum 8, insignificantly surrounded by sclerotisation.



Figs. 8–10. Female genitalia of *Leucoptera*. **8.** *L. orobi*. **9.** *L. orobi* (lectotype). **10.** *L. lathyrifoliella*.

Life history. Emmet (1985) reports *L. lathyrifoliella* from *Lathyrus sylvestris*. John Langmaid (personal communication) has reared this species from *Lathyrus pratensis*. In Finland it has been reared from both *Lathyrus sylvestris* and *Lathyrus linifolius*. In Finland it has also been found in sites where no *Lathyrus* grows, only *Vicia cracca* and *V. sepium* present as possible host plants. However, to our knowledge it has never been reared from either of these plant species. *L. lathyrifoliella* has two generations in Finland as in England. The first generation flies from late May to mid-June, and the second generation during July.

Distribution. Finland, Germany, U. K. (England).

Remarks. The type series of *L. lathyrifoliella*, preserved in BMNH, does not contain any specimens with abdomen left. There are no slides available, either. We base our opinion on the identity of the name *L. lathyrifoliella* on recent samples collected in close vicinity of the type locality. These specimens, both the male and females examined, share all the genital features of *L. lathyrifoliella* of authors. However, the abdominal seta vestiture is quite dense, like on specimens of *L. orobi*. This indicates that this character may be more variable than otherwise observed.

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We are deeply indebted to the following persons for loan of material: K. P. Bland, Jari Junnilainen, John Langmaid, Wolfram Mey, Marko & Tomi Mutanen, K. Nupponen, K. R. Tuck (The Natural History Museum, London) and Kari Vaalamo. Wolfram Mey and two anonymous referees are also thanked for their valuable comments

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On the identity of *Epinotia berolinensis* (Amsel, 1932) (Tortricidae: Olethreutinae)

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Abstract. After studying the female holotype of *Epiblema berolinensis* Amsel, 1932, the name was found to be a synonym of *Rhopobota stagnana* ([Denis & Schiffermüller], 1775).

Zusammenfassung. Der Name *Epiblema berolinensis* Amsel, 1932 syn. n. wird nach Untersuchung des weiblichen Holotyps als Synonym von *Rhopobota stagnana* ([Denis & Schiffermüller], 1775) erkannt.

Key words. Lepidoptera, Tortricidae, Olethreutinae, *Epinotia*, *Rhopobota*, synonymie

In the spring of 2004 I had the possibility to carry out some studies on the Tortricidae of the Staatliches Museum für Naturkunde, Karlsruhe. By chance I found the holotype of *Epiblema berolinensis* Amsel, 1932 (Fig. 1). Amsel (1932: 18–19) described this species on the basis of one female from Berlin–Lichterfelde captured on July 18th, 1928. He compared it with *Epinotia nemorivaga* (Tengström, 1848) (then placed in *Epiblema*), but pointed out that *E. berolinensis* has an isolated position within the genus *Epiblema* Hübner, [1825].

Razowski (2001, 2003) mentioned this species as *Epinotia berolinensis* (Amsel, 1932). Because the holotype was considered to be lost for a long time the status of the species could not be verified (Razowski 1999, 2003).

After dissecting the genitalia it was found that *E. berolinensis* is actually the same as *Rhopobota stagnana* ([Denis & Schiffermüller], 1775) under which name it is here synonymized (*Epiblema berolinensis* Amsel, 1932 **syn. n.**). The female genitalia (Fig. 2) show the characteristic slender sclerite of the posterior part of the corpus bursae, the laterally extended sterigma, and the broad shape of the subgenital sternite. The forewings of the type specimen of *E. berolinensis* are very poorly marked and the grey ground-color is dusted with light yellow scales. That is the reason why at first glance this holotype resembles *Epinotia sordidana* (Hübner, 1824). However, upon closer examination the characteristic pattern of *Rhopobota stagnana* ([Denis & Schiffermüller], 1775) is recognizable and *E. berolinensis* just represents a yellowish, poor patterned aberration of *R. stagnana*. The latter is not common in the counties of Berlin and Brandenburg (Blackstein 2002), but was already mentioned by Amsel (1930) for Berlin-Lichterfelde.

Acknowledgements

I wish to thank Dr. R. Trusch, Staatliches Museum für Naturkunde Karlsruhe (LNK) for the loan of the specimen and his support during my visit in Karlsruhe as well as Mrs. Ch. Hebig and Dr. M. Nuß, Staatliches Museum für Tierkunde Dresden, for providing literature and for arranging the photo.

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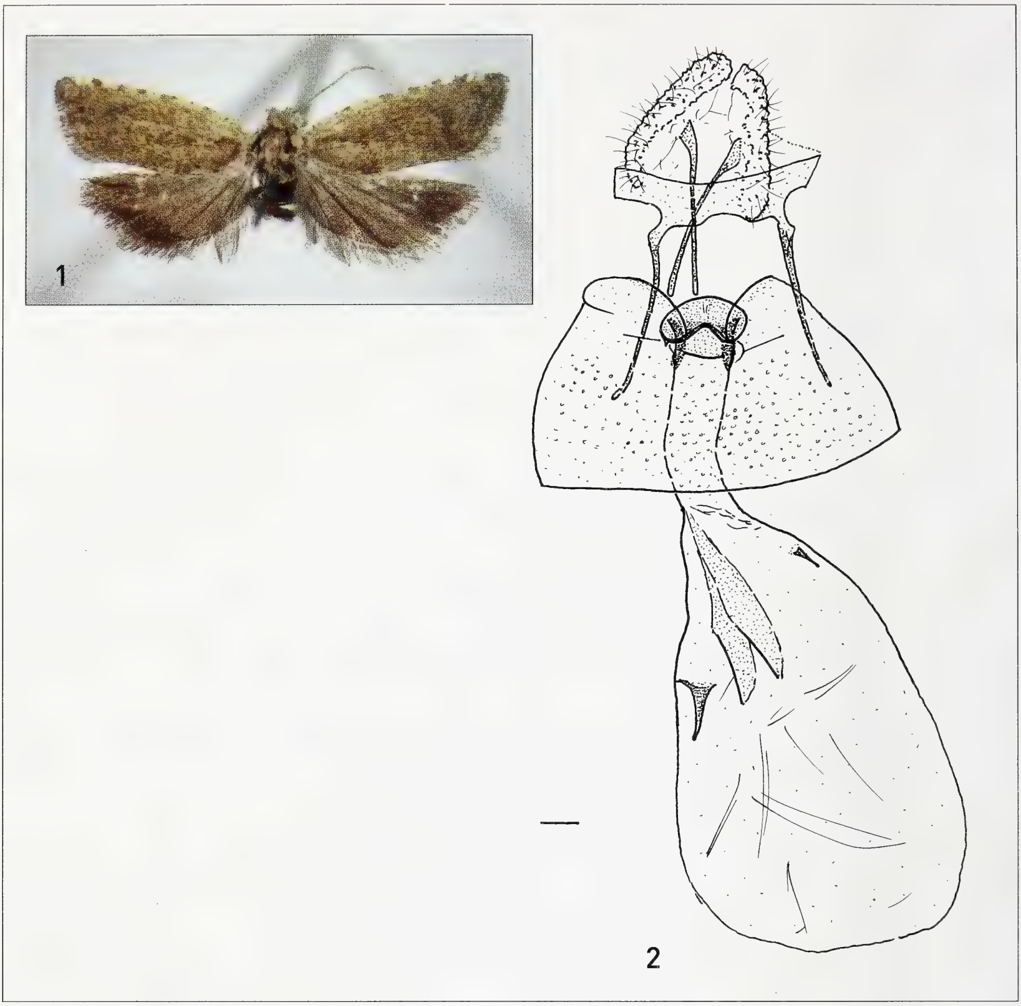

Figs. 1–2. Holotype of *Epiblema berolinensis* Amsel, 1932 from [Germany], Berlin-Lichterfelde, 18.vii.1928, H. Amsel leg. (prep. Karisch 1780), SMNK. **1.** Habitus. **2.** Female genitalia (scale 0.1 mm).

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Nota lepid. **27** (2): 195–197

What is *Cossus sareptensis* Rothschild, 1912 (Cossidae)?

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Abstract. A new combination, *Holcocerus sareptensis* (Rothschild, 1912) **comb. n.,** is proposed and a redescription is given for this rare and little-known species of Cossidaefrom the Volga region in Russia.

Key words. *Cossus sareptensis*, *Holcocerus*, Volga region, Russia.

Presently, Cossidae still remain one of the less studied families of Macroheterocera. For instance, the recently published catalogue of the Lepidoptera of Europe, which included Cossidae (de Freina 1996), missed the little-known *Cossus sareptensis* Rothschild, 1912, considered below.

Cossus sareptensis was described by Rothschild (1912: 451) based on a single male. The type locality was given as "Sarepta" (now Krasnoarmeisk, Volgograd Province, Russia). This species, described within the genus *Cossus* Fabricius, 1793, was mentioned by subsequent authors (Daniel 1956: 278, pl. 10 fig. 3; Zagulyaev 1973: 184; Anikin, Sachkov & Zolotuhin 2000: 275) in the original combination although these authors did not examine the holotype; only F. Daniel had a black-and-white photograph. Through the courtesy of the Trustee Council of The Natural History Museum (British Museum [Natural History]) I was provided with a high quality scan of the holotype, its genitalia slide, and the labels. The exterior, genitalia (the uncus shape, the structure of the transtilla processes, the specific round tubercle on the valva), and the antennal structure (with no pectinate processes on segments) (Daniel 1959) provide evidence that the species belongs in fact to the genus *Holcocerus* Staudinger, 1884 (type species: *Cossus* (*Holcocerus*) *nobilis* Staudinger, 1884, by original designation). Therefore, a new combination is proposed. Taking into account the lack of information concerning this species, a redescription is provided.

Holcocerus sareptensis (Rothschild, 1912) comb. n. (Figs. 1–3)

Cossus sareptensis Rothschild, 1912: 451; Daniel, 1956: 278, Taf. X: 3; Zagulyaev, 1973: 184; Anikin, Sachkov & Zolotuhin, 2000: 275.

Material. Holotype P (by monotypy): a well-preserved specimen with the abdomen's distal end cut off and the following labels: (1) handwritten on white paper in a blue box in Indian ink "Srpt.[Sarepta] | Stgr.[Staudinger]"; (2) handwritten on red paper in Indian ink "*Cossus* | *sareptensis* | Type, Rothsch.[ild]"; (3) printed round label with red margin "Type"; (4) typed on blue paper "Cossidae | genitalia slide | No. 239" (The Natural History Museum, London).

Redescription. Wing expanse 31 mm, forewing length 13 mm. Antenna not pectinate, its segments without processes. Forewing upperside ground-color light-brown; pattern lighter in middle and with narrow wavy lines becoming more distinct closer to outer margin; fringe ochre-colored, darker at vein apices. Hindwing upperside grey without pattern; fringe ochre-colored.

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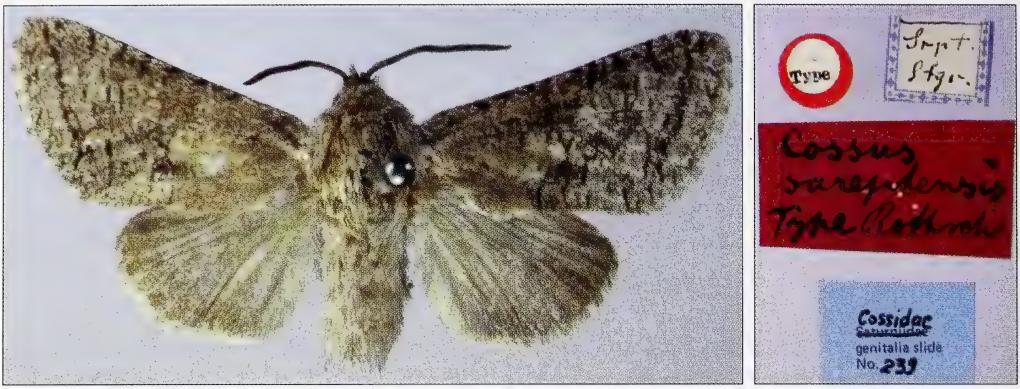

Figs. 1–2. Holotype of *Holcocerus sareptensis* (Rothschild, 1912). **1.** Specimen. **2.** Labels.

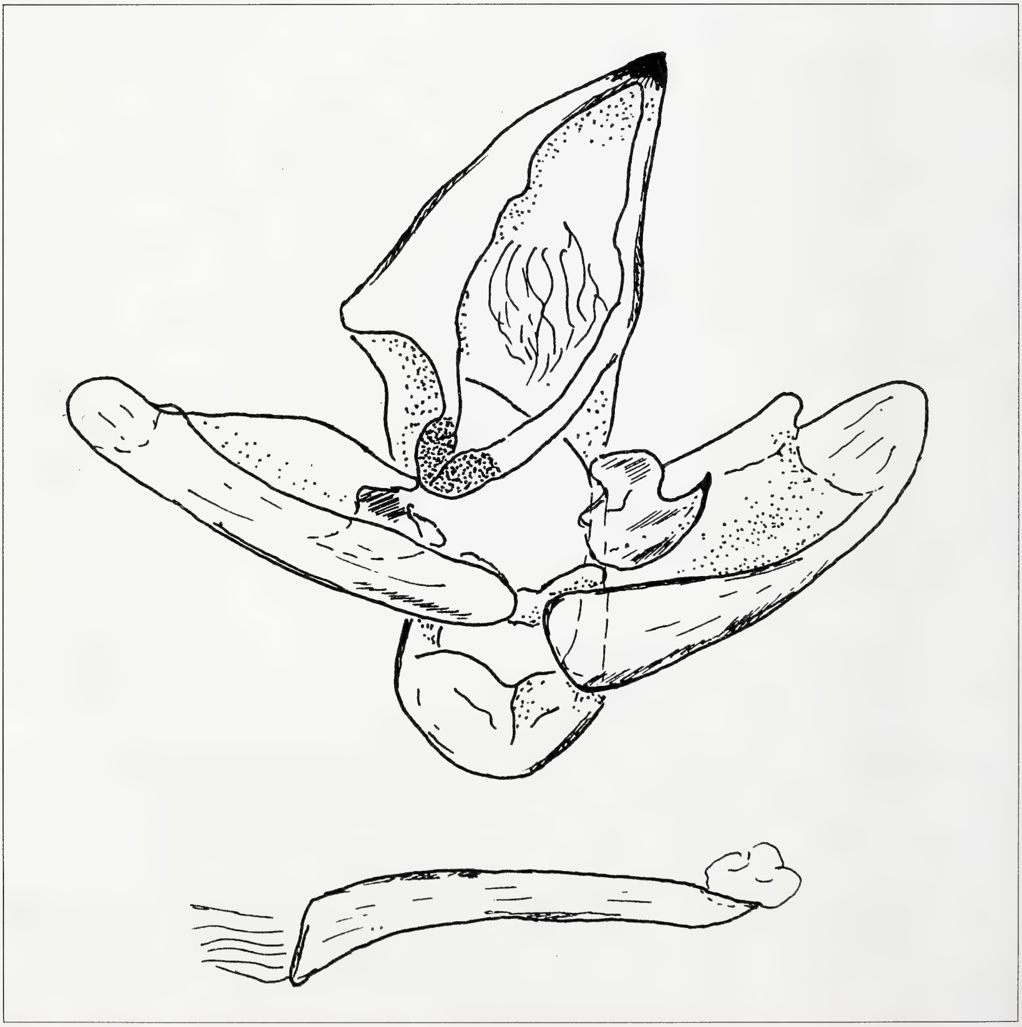

Fig. 3. *Holcocerus sareptensis* (Rothschild, 1912), holotype, genitalia, frontal projection

Male genitalia. Uncus blunt, angular, short, thickly sclerotized at apex. Gnathos arms long. Gnathos blade-like, formed by two merged halves. Valva characteristic of genus *Holcocerus*, sclerotized with membranous apex, wide with a round tubercle on dorsal margin. Arms of transtilla hook-shaped (with curved distal ends) well sclerotized. Saccus round. Aedeagus curved. Vesica without cornuti.

Female. Unknown.

Distribution. Known only from the type locality, Krasnoarmeisk in the Volgograd Province, Russia.

Remarks. This is quite a peculiar species quite well differing from other known representatives of the genus by a reduced wing pattern and a wide uncus. Externally, it is most similar to the Central Asian *Holcocerus campicola* (Eversmann, 1854).

Acknowledgements

The kind help of Mr. Geoff Martin (The Natural History Museum, London), curator of the Moths collection, made this study possible. The images are published with permission of the Council of Trustees of this museum.

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The book series Esperiana, of which the first volume became published in 1990, predominantly deals with the taxonomy and faunistic of Palaearctic Noctuidae and insects from Yemen. Now, the tenth volume of the series has been published, containing three works on Noctuidae. The majority of this volume, altogether 683 pages and 27 colour-plates, is occupied by a comprehensive revision of the genus *Caradrina* Ochsenheimer, 1816 (Noctuidae: Amphipyrinae: Caradrini) by Hermann Hacker. Two other papers are dealing with a first record of *Caradrina suscianja* from Italy (two pages written by Stoyan Beshkov, Andrea Grassi & Alberto Zilli) and the *Eublemma*-species from Yemen (26 pages and two colour-plates written by Michael Fibiger & Hermann Hacker). The entire volume is completed by an alphabetic index of the scientific names.

The *Caradrina*-revision gives diagnoses and autapomorphies for the *Caradrina*-genus group, comprising beside *Caradrina* the genera *Hoplodrina* Boursin, 1937, *Stenodrina* Boursin, 1937, and *Stygiodrina* Boursin, 1937. Diagnoses and autapomorphies are also given for the eight subgenera of *Caradrina*, of which four are newly described. 33 species and 11 subspecies are described as new, the status of 12 species-group-names is changed, 21 species group names are regarded as new synonyms, and 26 species are transferred to other genera. Altogether, *Caradrina* now comprises 155 species. Most of them occur in the Palaearctic region, a few are known from the Nearctic and Afrotropical regions. For each species, historical descriptions are cited with full text, the examined material is listed and a diagnosis of external and genitalia characters including variability and possibilities for misidentifications are given. The distribution of each species is explained in detail and supported by a distribution map. Finally, reference is made to life-history data. The entire revision concludes with the numerous colour-figures of the moths and high quality black and white photographs of the genitalia slides. Text and figures of the revision enable the reader to identify the taxa dependably. Outstanding are the explanations on male genitalia characters and their terminology, the quality of the many genitalia figures as well as the colour figures of the moths specimens and their labels.

Although the author writes much about the phylogeny of the taxa treated and that 'the results were scored and documented in matrices', no details are presented. Indeed, nothing is stated which program has been used, a character matrix and a tree are absent. It remains questionable for the reader, why the results of this huge work are not shown and thus all the statements on the phylogeny can not be verified. The English text contains several vague wordings and the distribution maps do not show the precise dots of available records given in the material chapters. However, despite of these three critical points, the revision is well done and illustrated and follows the normal standards for a revision. All taxonomic information given can be verified and the results allow to identify the superficial very similar species of *Caradrina*.

MATTHIAS NUSS

Nota lepid. **27** (2/3): 199–216

Discovery of the genus *Epimarptis* Meyrick, 1914 (Gelechioidea: Coleophoridae s. l.) in Japan, with the description of a new species

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Abstract. *Epimarptis hiranoi* sp. n. is described on the basis of specimens collected at several localities in Honshû, Japan. The following characters are illustrated: the habitus, head appendages, wing locking system and venation, thoracic and abdominal skeletons, abdominal vestiture, and genitalia. *E. hiranoi* is the fourth member of the genus *Epimarptis* Meyrick, 1914 and the first representative discovered in regions other than South Asia. It can be distinguished from congeneric species in the colouration of the forewing. In the thoracic skeletons, the new species has several characters not found in other genera of Coleophoridae s. l..

Key words. *Epimarptis hiranoi* sp. n., Japan, head appendages, thoracic skeletons, genitalia, *Epimarptis*, Coleophoridae s. l..

Introduction

Meyrick (1914) established the genus *Epimarptis* to describe the type species, *Epimarptis philocoma* Meyrick, 1914. Up until now the genus had been represented by three species (Meyrick 1914, 1917, 1931, 1936): *E. philocoma* was recorded from Bombay, India, *E. septicodes* Meyrick, 1917 from Maskeliya, the Democratic Socialist Republic of Sri Lanka, and *E. isoloxa* Meyrick, 1931 from Assam, India. Most of the generic characters of *Epimarptis* given in the original description are typical of the members of superfamily Gelechioidea where the genus is currently placed. Excluding the characters typical of gelechioids, the generic characters given in the original description are as follows: antennae in male near the base with a notch covered by an oblique tooth beneath it; pecten absent; in forewing venation M1 stalked with stem of R4+5, R5 reaching termen instead of costa; in hindwing venation Rs and M1 stalked, M2 absent. The presence or absence of a pecten sometimes varies within a genus. Smaller-sized gelechioids generally have the forewing M1 stalked with the stem of R4+5 and the hindwing with less than three M-veins. According to Meyrick (1931), *E. isoloxa* has the same wing venation as the type species. On the other hand, Meyrick (1917) stated that *E. septicodes* is different from the type species in having the forewing with CuA1 absent and M1 separated from the stem of R4+5. Consequently, among the generic characters in the original description, the effective diagnostic characters of *Epimarptis* are restricted to the male antennal notch covered by a tooth and the forewing with R5 reaching the termen.

When establishing the genus *Epimarptis*, Meyrick (1914) proposed the family Epimarptidae for this genus alone, stating "Probably it is a development of the Oecophoridae." Later, however, Meyrick (1917) transferred the genus to the Epermeniidae and maintained this idea in subsequent papers (Meyrick 1931, 1936).

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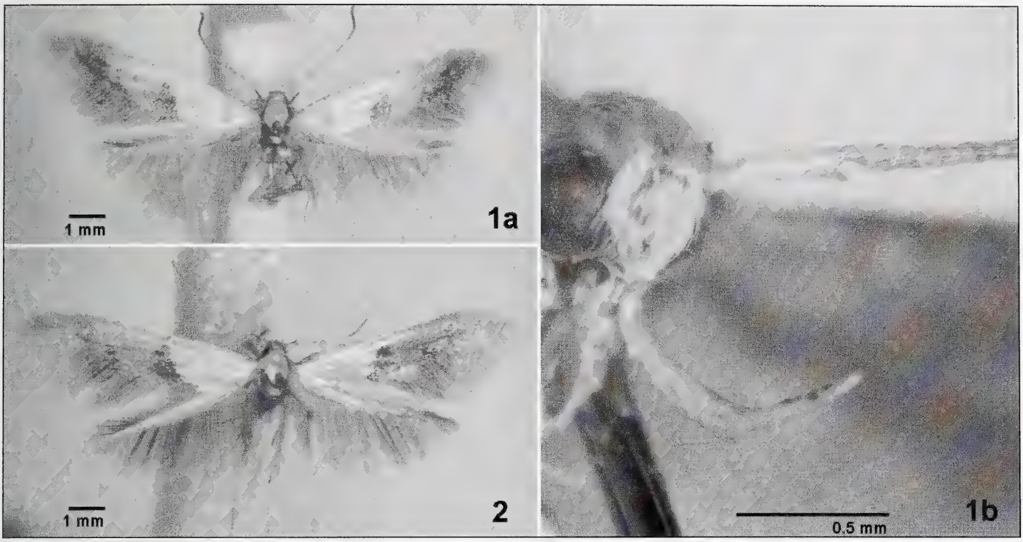
Current limits of the superfamily Gelechioidea were generally accepted in the late 1960's, and since the late 1970's, rearrangements of the gelechioid family-group taxa have been attempted repeatedly. Minet (1986) was the first author to include *Epimarptis* in the superfamily. Later authors, when taking the genus into account, regarded it as forming solely the family Epimarptidae (Minet 1990; Sinev 1992) or the subfamily Epimarptinae of the family Batrachedridae (Hodges 1998). Kaila (2004) implemented a cladistic analysis of 143 gelechioid taxa using 193 morphological characters in order to estimate phylogenetic relationships within Gelechioidea. He stated that *Epimarptis* would fall in his expanded Coleophoridae comprising *Coelopoeta* Walsingham, 1907, *Stathmopoda* Herrich-Schäffer, 1853, and Batrachedrinae of Hodges (1998) in addition to Coleophoridae in the traditional sense, while abundant missing entries for *Epimarptis* prevented him from including the genus in his final analysis.

In spite of many recent studies on the taxonomic system within Gelechioidea, little morphological information is available for *Epimarptis* in the literature. The genitalia have never even been described and there are no available illustrations except for the figures of the moth and hindwing venation of the type species given by Hodges (1998). In the higher classification of the microlepidoptera, the head appendages and thoracic skeletons often offer some phylogenetic evidence, but these characters have not yet been examined in *Epimarptis*. *Epimarptis* is currently accepted as the type genus of a nominal family-group taxon, and current lack of information must be improved in order to obtain a more reliable hypothesis of its relationships within Gelechioidea.

On recent examination of some personal and institutional collections in Japan I found several Japanese specimens apparently referable to *Epimarptis*. These specimens have the male antennae with a notch near the base and the forewing with vein R5 reaching the termen. In addition, they agree with the original description of *E. philocoma* in many aspects of wing markings and also with a moth photo of the species in Hodges (1998). By courtesy of Mr K. Tuck and H. Taylor of The Natural History Museum, London (BMNH), I was able to compare my Japanese specimens with images of *Epimarptis* specimens in the BMNH, i.e. moth images of the type specimens of all described species and genitalia images of one male and two female non-type specimens of *E. philocoma*. Then I concluded that the Japanese specimens represented an *Epimarptis* species distinct from all described ones. Discovery of *Epimarptis* in Japan had not been expected because the genus has never been recorded even in Southeast Asia. The Southeast Asian fauna is generally much more similar to that of South Asia than to that of Japan.

In the present paper, I describe the Japanese *Epimarptis* species as the fourth member of the genus. For a better understanding of the genus and also of the Gelechioidea as a whole, I give illustrations not only of the habitus and genitalia, but also of some other characters that are usually neglected in species descriptions. A discussion is given on the morphology of the Japanese species mainly from the viewpoint of comparing it with that of some other genera placed in Coleophoridae by Kaila (2004).



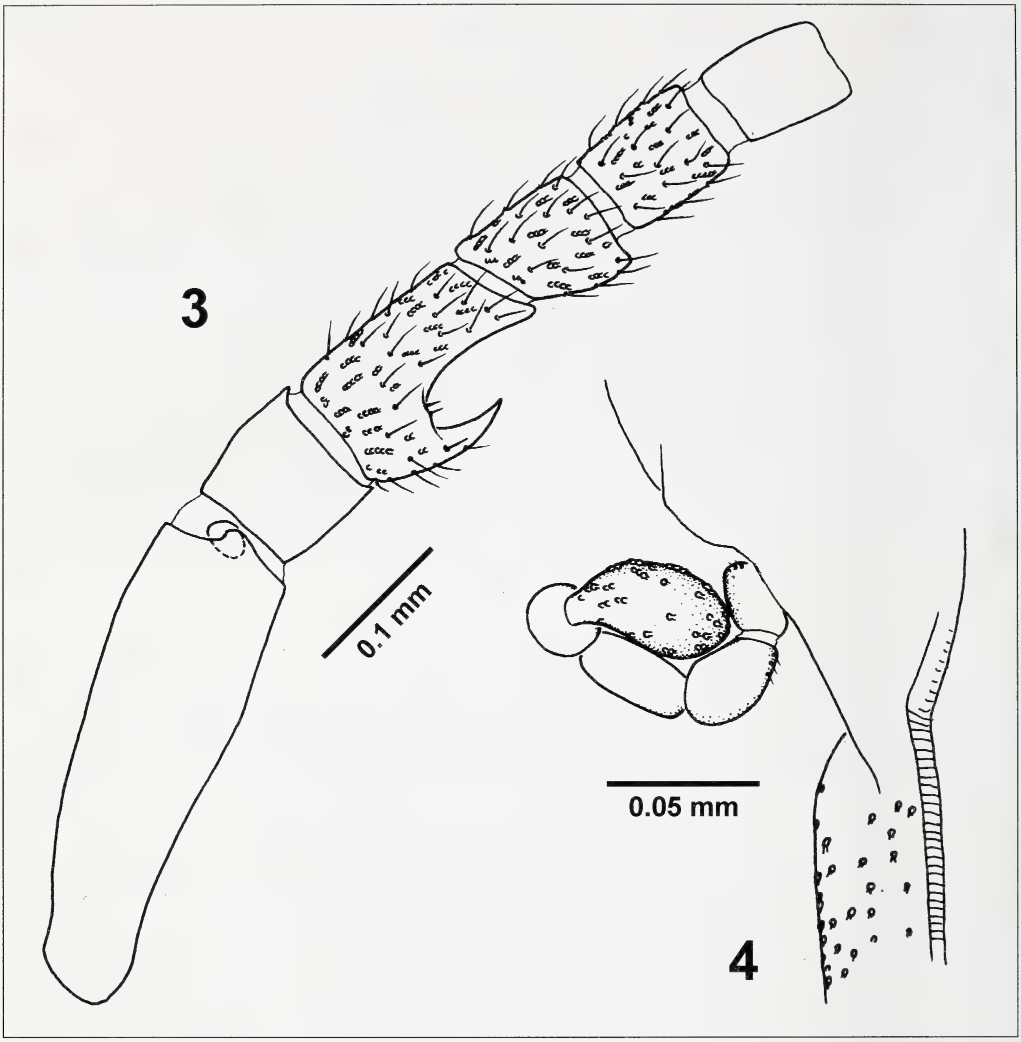
Figs. 1–2. Moths of *Epimarptis hiranoi* sp. n. **1.** Holotype (a: Whole moth, with abdomen removed for dissection. b: Antennal notch). **2.** ♀ paratype from Inekoki.

Epimarptis hiranoi sp. n. (Figs. 1–20)

Material. All specimens collected in Honshû, Japan. Holotype: ♂, 'Japan; Honsyû <underlined> | Kamasawa[-onsen] <35°30'N, 138°06'E> | Oosika Vill.[age] | Nagano Pref.[ecture] | 24,vi,2001 | K. Sugisima leg.', '♂ genitalia | slide no. 0910 | K. Sugisima, 2001', deposited in Entomological Laboratory, Osaka Prefecture University, Sakai-si, Ôsaka-hu, JAPAN (OPU). — Paratypes: 1♂, 'Fujihara-Dam <36°48'N, 139°03'E> | Minakami Machi | Gunma Pref. | 12.VI.1999 | U. Jinbo <leg.>'; 1♂, 'Ikezawa <36°24'N, 137°57'E> | Ikusaka mura | Nagano-ken | 29.VII.1995 | N. Hirano leg.'; 1♀, 'Ookuchizawa <36°17'N, 137°57'E>, Toyo- | shina T. Nagano | pref. 13 JUL 1979 | N. HIRANO leg.'; 1♂, 'Ohkuchizawa <36°17'N, 137°57'E>, To- | yoshina Nagano | pref. 10 VI 1983 | N. HIRANO leg.'; 1♂, 'Japan; Honsyû <underlined> | Ookuti-zawa <36°17'N, 137°57'E> |Toyosina Town | 19,vii,2003 | K. Sugisima leg.'; 1♀, 'Shimashima valley <36°11'N, 137°46'E> | Nagano pref. | 9 VII 1981 | N. HIRANO leg.'; 1♀, 'Shimashima valley <36°11'N, 137°46'E> | Nagano pref. | 26 VI 1982 |N. HIRANO leg.'; 1♂, 'Shimashima-dani <36°11'N, 137°46'E> | Azumi-mura | Nagano-ken | 19.VI.1987 | N. HIRANO [leg.]'; 1♂1♀, 'Inekoki <36°09'N, 137°46'E> | Azumi-mura | Nagano-ken | 9.VII.1988 | N. HIRANO [leg.]'; 1♂, ' [Kiso]Hukusima <Kawanisi> <36°50'N, 137°41'E> | Nagano-ken | Honsyu | Japonia', '8/VII | 1975 | T. KUMATA [leg.]'; 1♀, 'JAPAN | HONSYU, NAGANO: | Kamasawa[-onsen] <35°30'N, 138°06'E> | (Osika-mura) | 30.VI.2001 | T. SAITO [leg.]'; 1♂1♀ (1♀ whole insect mounted on slide 1737 of K. Sugisima), '13-JUL-1996 | JAPAN Aichi-pre. <underlined> | Asahi-highland <35°13'N, 137°24'E> | Asahi-cho | T. Mano leg.'; 2♂ (1♂ whole insect mounted on slide 0614 of K. Sugisima), '5-JUL-1997 | JAPAN Aichi-pre. <underlined> | Asahi-highland <35°13'N, 137°24'E> | Asahi-cho | T. Mano leg.'; 1♂, 'JAPAN: Mie-pre. <underlined> | Hijiki [34°42'N, 136°11'E] [alt.] 250 m | Ueno-city | 27-VI-1997 | T. Mano leg.'; 1♂, 'Yase | Kyoto[-city] | 26.vi.1952 | A. Mutuura [leg.]'; 1♂, 'Japan; Honsyû <underlined> | Tyôzya-hara <34°41'N, 132°11'E> | Geihoku-tyô | 10,vii,2001 | Ohshima-Issei leg. (Paratypes deposited in OPU, SEHU (Systematic Entomology, Hokkaido University, Sapporo, Japan), and BMNH (The Natural History Museum, London)). – 2♂2♀, Ôkuchi-zawa, Toyoshina, Nagano Pref. (in personal collection of N. Hirano).

Description. Male (Fig. 1) and female (Fig. 2) with no differences in size and coloration. Forewing length 5.3–6.0 mm (holotype 5.7 mm).

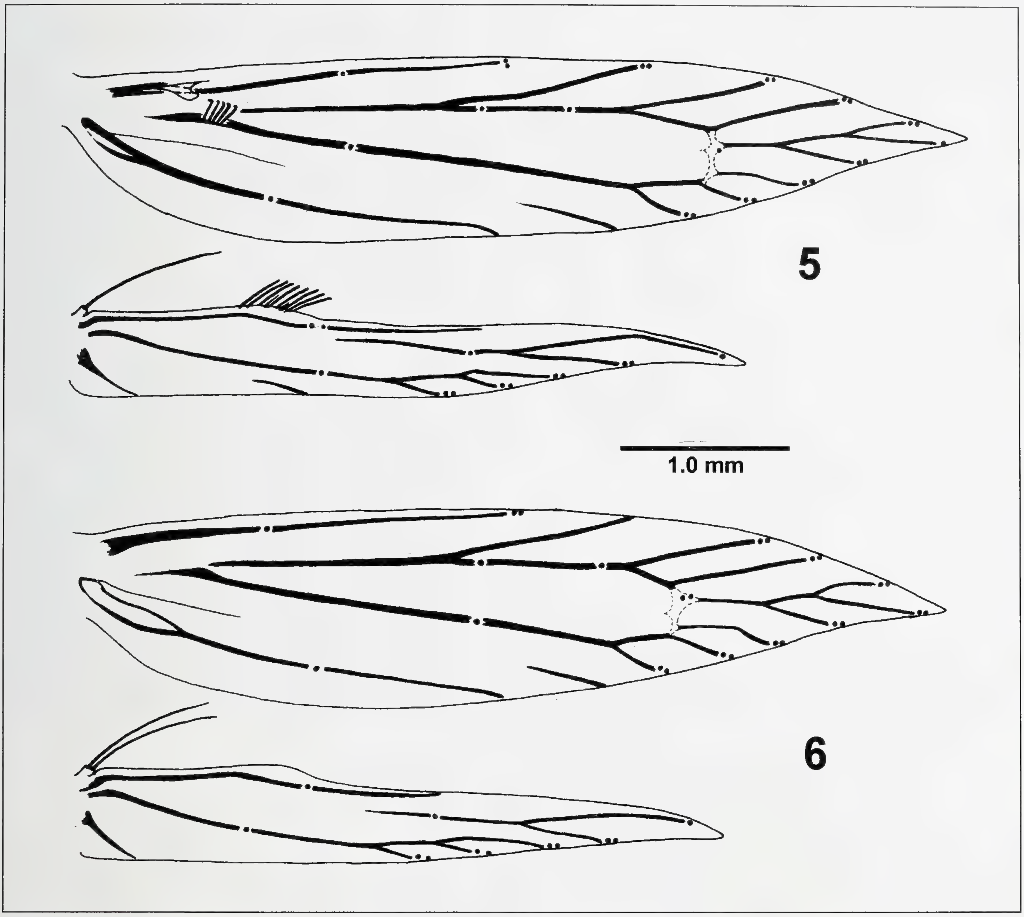
Head yellowish with a row of dark brownish scales above dorsal margin of eye. Antenna 4/5 as long as forewing; basal notch and covering tooth of male due to modification of third segment (Figs. 1b, 3); coloration yellow-ochreous, scape paler,



Figs. 3–4. Head appendages of *Epimarptis hiranoi* sp. n. (♂ paratype from Asahi highland, slide no. 0614 of K. Sugisima). **3.** Basal segments of antenna. **4.** Maxillary palpus.

flagellum annulated with dark brownish except on apical flagellomeres. Labial palpus yellowish, medially paler, densely mottled with dark brownish scales on third segment and often also at apex of second segment dorsally. Proboscis well developed, scale on basal 3/4; maxillary palpus (Fig. 4) composed of five segments, second and third segments cylindrical, fourth spherical, fifth bullet-shaped. Thorax yellowish, mottled with dark brownish scales on cephalic partof tegula. Legs pale ochreous, densely mottled with dark brownish scales on outer surface of fore tibiae, sparsely elsewhere; hind tibia dorsally ornamented with long soft hair-like scales. Abdomen pale ochreous dorsally, ivory ventrally.

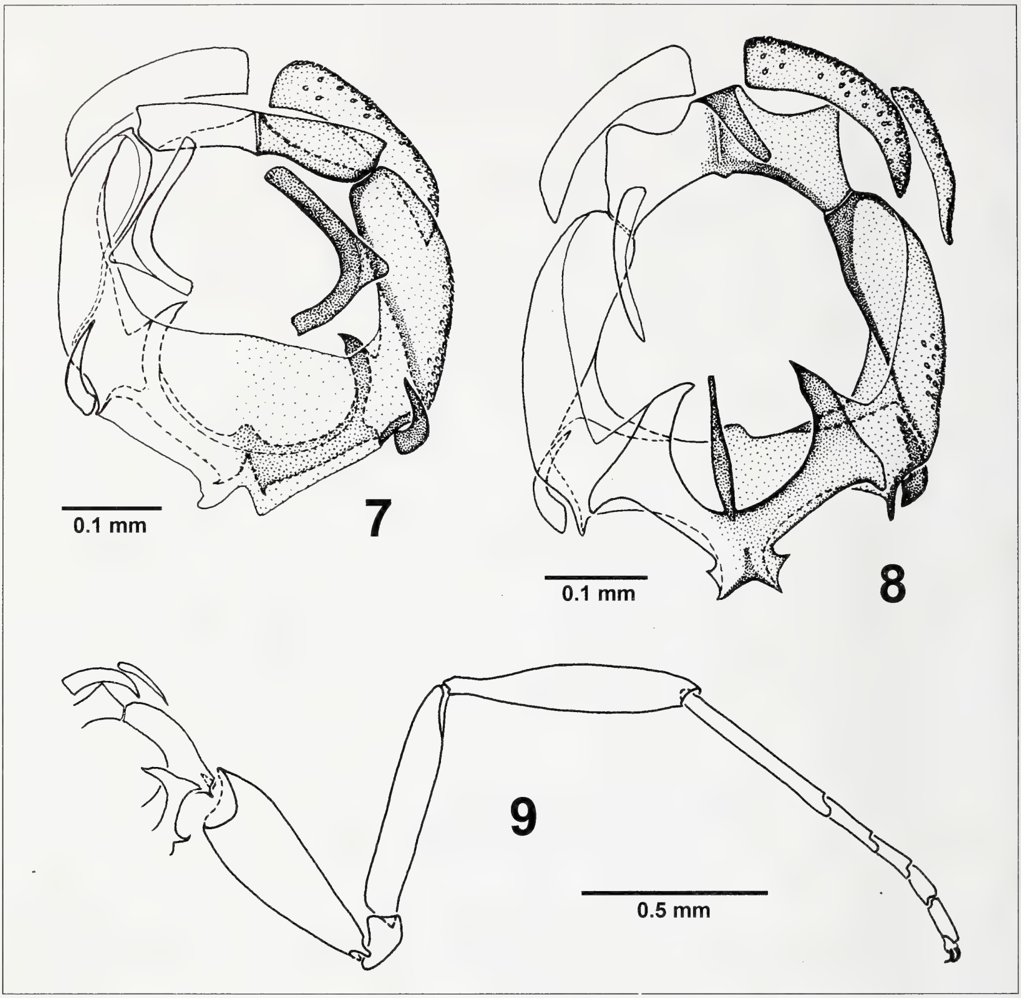
Forewing moderately lustrous, yellowish from base to 2/5, where a dark brownish triangular patch extends outwards obliquely from hind margin just beyond R-stem,



Figs. 5–6. Wing venation of *Epimarptis hiranoi* sp. n.; dots indicate positions of campaniform sensillae. **5.** ♂ paratype from Inekoki, slide no. 0580 of K. Sugisima. **6.** ♀ paratype from Shimashima-dani, wing-locking scales omitted, slide no. 0583 of K. Sugisima.

thence wing becoming orange-brownish to brownish near termen; another dark brownish triangular patch present around tornus, half as wide as first one; with another dark brownish patch of variable size and shape near apex of wing; each dark brownish patch almost unicolourous, with no gradation; costa thinly edged with dark brownish scales; cilia orange brownish, darker around tornus.

Wing structures (Figs. 5, 6). Forewing elongate lanceolate, 1/4–1/5 as wide as long, widest around 1/3, apically pointed; Sc reaching costal margin slightly beyond middle; cell almost closed around 1/8 because CuA-stem closely approaching R-stem, rudimentary between base of R3 and base of CuA1; R1 and R2 twice to three times as distant from each other as R2 and R3 are; M1 stalked with stem of R4+5; one of M2 or M3 absent (or M2 and M3 fused); CuP recognised as vein distally, as fold basally; anal vein bifurcate basally. Hindwing half as wide as forewing, linear-lanceolate, widest beyond 1/3; costal margin slightly projecting beyond 1/3; Sc+R1 nearly parallel to costa, ending at 2/3; Rs very weak in basal half, one branch arising caudally



Figs. 7–9. Denuded prothorax of *Epimarptis hiranoi* sp. n. **7.** Cephalic view of prothorax (♀ paratype from Asahi highland, slide no. 1737 of K. Sugisima); parapatagia omitted. **8.** Caudal view of prothorax (♂ paratype from Asahi highland, slide no. 0614 of K. Sugisima). **9.** Foreleg (♂ paratype from Asahi highland, slide no. 0614 of K. Sugisima).

from Rs, three branches arising from CuA-stem. Subcostal element of retinaculum in male arising from stalk of Sc; caudal element composed of a row of stout hooked scales along CuA-stem; frenulum with two acanthae in female; supplementary wing-locking system as a group of elongate scales around hind margin of forewing and a group of long needle-like scales arising from projection of costal margin of hindwing. Thorax (Figs. 7–12). Preepisternum without a membranous window in its lateral projection (Fig. 7). Parapatagium as a distinct pad-like sclerite, with sockets (Fig. 8). Fore tibia without epiphysis (Fig. 9). Cephalic margin of metascutellum round and totally margined by its internal folding (Figs. 10, 11a). Caudal margin of metathorax with a medial ridge (Fig. 11a). Caudal suture of inner sclerite of metacoxa present (Figs. 10, 12a). Intercoxal lamella forming a simple keel (Fig. 11b). Margin of infra-

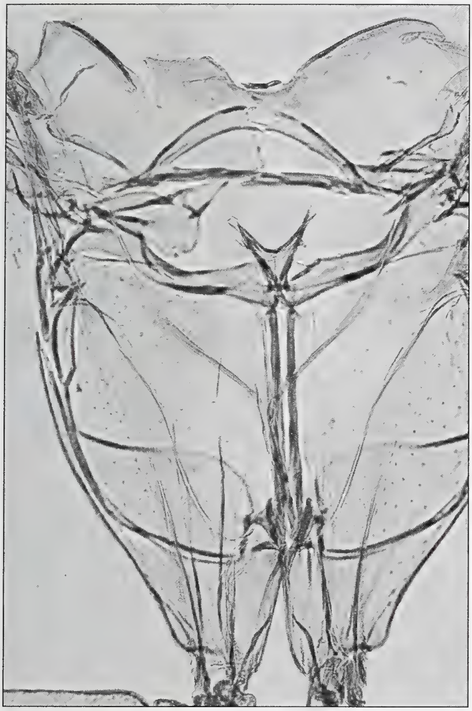


Fig. 10. Denuded metathorax of *Epimarptis hiranoi* sp. n. in dorsal view (♀ paratype from Asahi highland, slide no. 1737 of K. Sugisima).

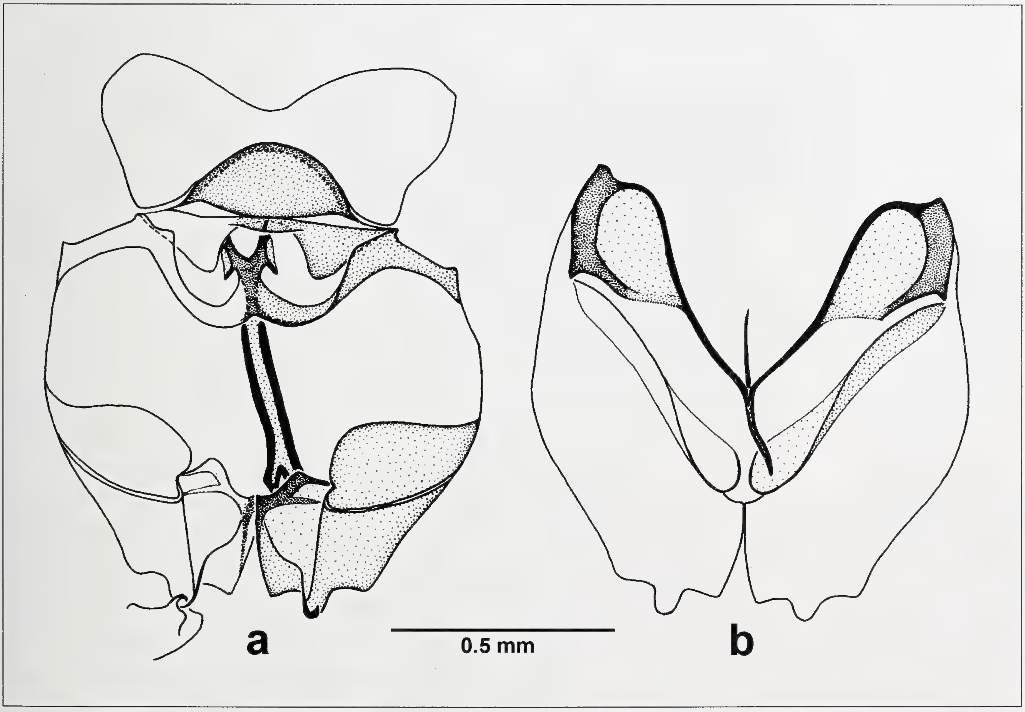


Fig. 11. Metathoracic skeleton of *Epimarptis hiranoi* sp. n. in caudal view (♂ paratype from Asahi highland, slide no. 0614 of K. Sugisima). a: Structures of dorsal half. b: Structures of ventral half.

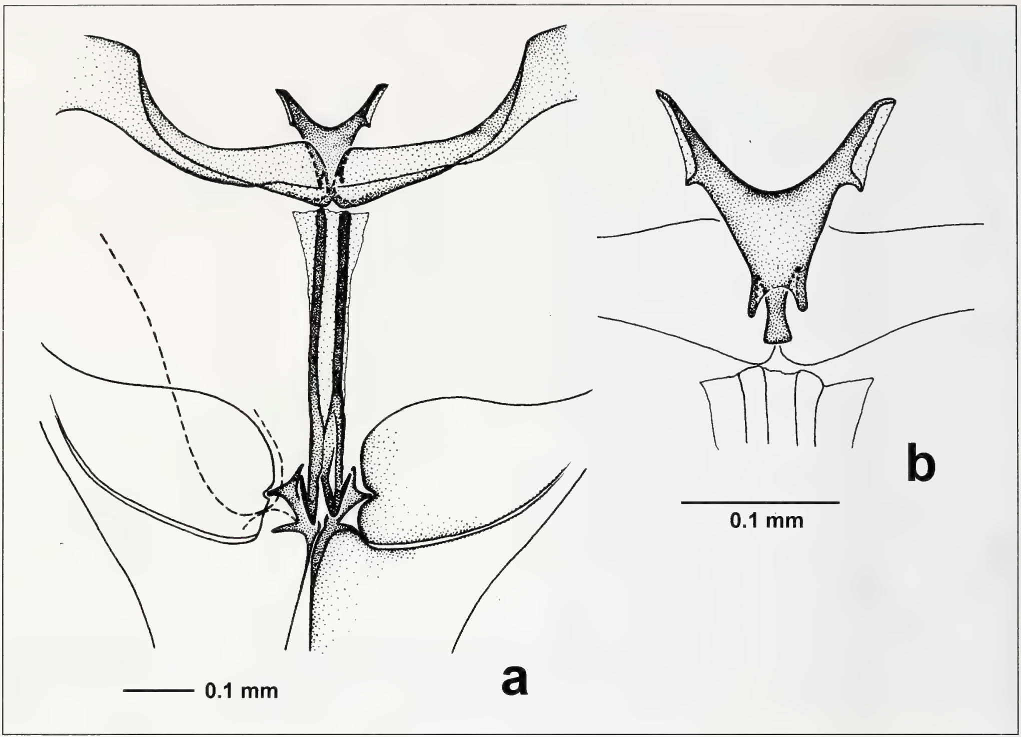
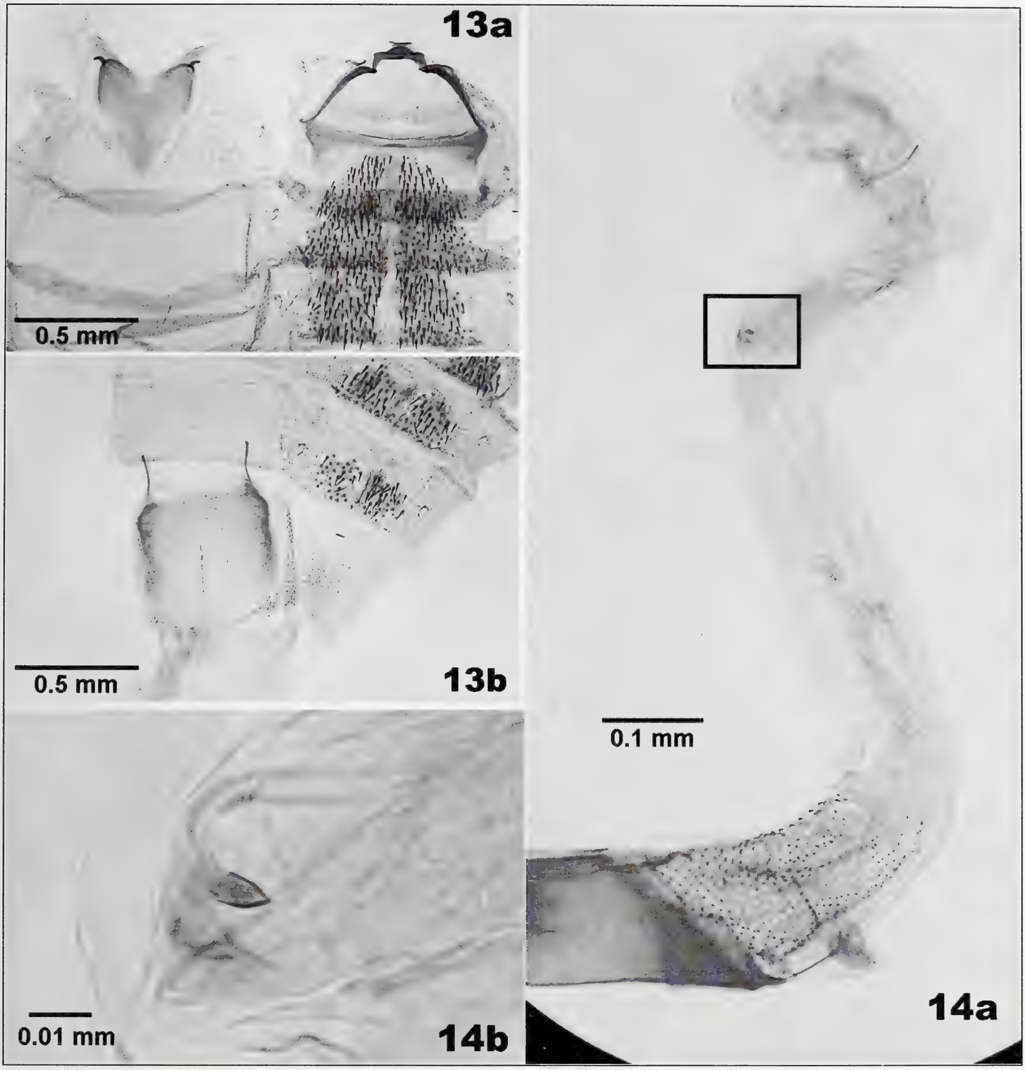


Fig. 12. Metathoracic furca in dorsal view (♀ paratype from Asahi highland, slide no. 1737 of K. Sugisima). a: Whole furcal structures and articulation with coxa. b: Furcal apophysis.

episternum strongly sclerotised, except for less sclerotised medial half of caudal part (Fig. 11b). Apophysis of metafurca (Fig. 12b) bluntly Y-shaped, cephalically bifurcate; each cephalic branch pointing toward cephalo-ventral and dorso-caudal corners; a pair of small projections directed dorso-caudally near caudal end of apophysis; secondary arm of furca and its lamina forming chiasma (Figs. 10, 11a, 12a); stem of furca composed of pair of longitudinal stout bars and less sclerotised lamina supported by these bars, with a relatively weak part around caudal 1/5 (Figs. 10, 12a).

Abdomen (Fig. 13). Abdominal supporting system of same structure in both sexes: ventral element composed of heavily sclerotised sub-pentagonal area with pair of short apodemes arising from cephalic corners and indistinct venulae forming margins. Second to seventh tergites each ornamented with pair of patches of spine-like scales.

♂ genitalia (Figs. 14–17) and associated structures (Fig. 13b). Eighth sternite (Fig. 13b) sclerotised more strongly than third to seventh sternites, with pair of apophyses arising sublaterally on cephalic margin. Uncus down-curved, abruptly narrowed near base and slightly tapering towards acute apex, with pair of setae present before apex. Gnathos (Figs. 15, 16b) articulated with tegumen, evenly tapering towards apex, strongly sclerotised along caudal margin, moderately so elsewhere; apex with a short point extending towards head. Tegumen tapering towards uncus, strongly sclerotised along margins of round cephalo-lateral corners. Inner



Figs. 13–14. Male abdomen and vesica of *Epimarptis hiranoi* sp. n. **13.** Abdominal segments of holotype (a: Cephalic four segments, showing structures of abdominal base and arrangement of 'spines' on tergites. b: Caudal two segments, showing modified eighth sternite). **14.** Vesica, paratype from Ookutizawa, slide no. 1295 of K. Sugisima (a: Whole vesica, largest cornutus surrounded by a square. b: Magnified view of squared area in Fig. 14a).

surface of valva (Fig. 16b) divided by a suture into equally long caudal and cephalic areas; caudal area sclerotised strongly along margin and weakly so elsewhere, with short setae scattered sparsely; cephalic area sclerotised moderately, with caudal margin medially projecting and forming strongly sclerotised club-shaped rod apically bearing one short seta. Outer surface of valva (Fig. 17) sclerotised strongly along dorso-cephalic margin near joint with tegumen and weakly to moderately so elsewhere, with dense group of very long hairs on cephalic part, with huge scales sparsely scattered on remaining part. Juxta (Figs. 15a, 16c) sub-triangular, on caudal margin

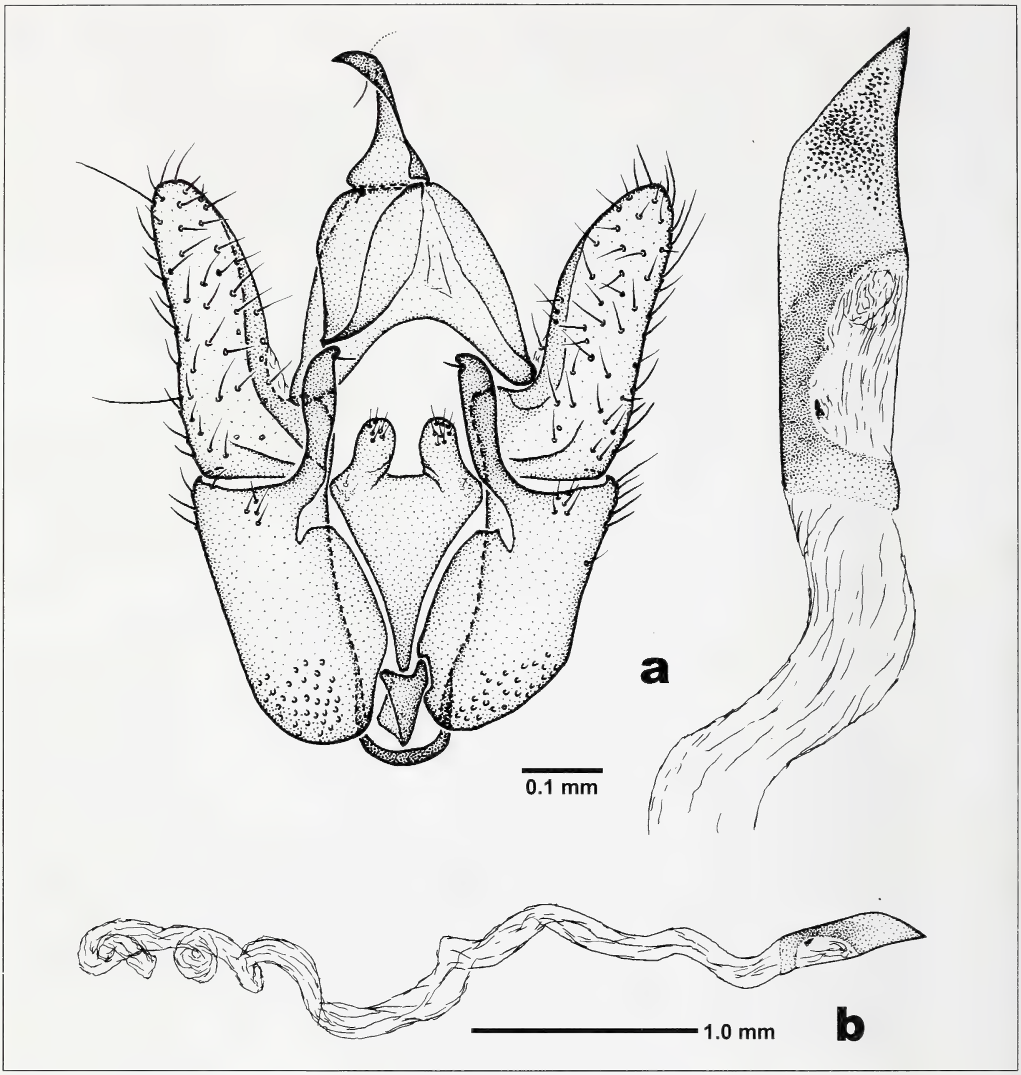


Fig. 15. ♂ genitalia of holotype of *Epimarptis hiranoi* sp. n. situated in standard position (a: Whole genitalia with ductus ejaculatorius omitted. b: Whole aedeagus).

with pair of thumb-shaped projections separated by distance equal to their basal width and apically adorned with six to ten setae; with dorsally concave pouch-like sclerite connected with cephalo-ventral corner of juxta. Diaphragma with group of a few setae dorsad from lateral corners of juxta. Vinculum narrow, U-shaped, with dorsal ends fused with dorso-cephalic margin of outer surface of valva. Aedeagus obliquely truncate apically, membranous on dorsal side and on ventro-cephalic area (Fig. 15a); ductus ejaculatorius very long (Fig. 15b); vesica (Fig. 14) over three times as long as aedeagus, lined with group of numerous minute spines near caudal opening of aedeagus and bearing thorn-like sclerite (considerably reduced in some individuals) distant from the opening.

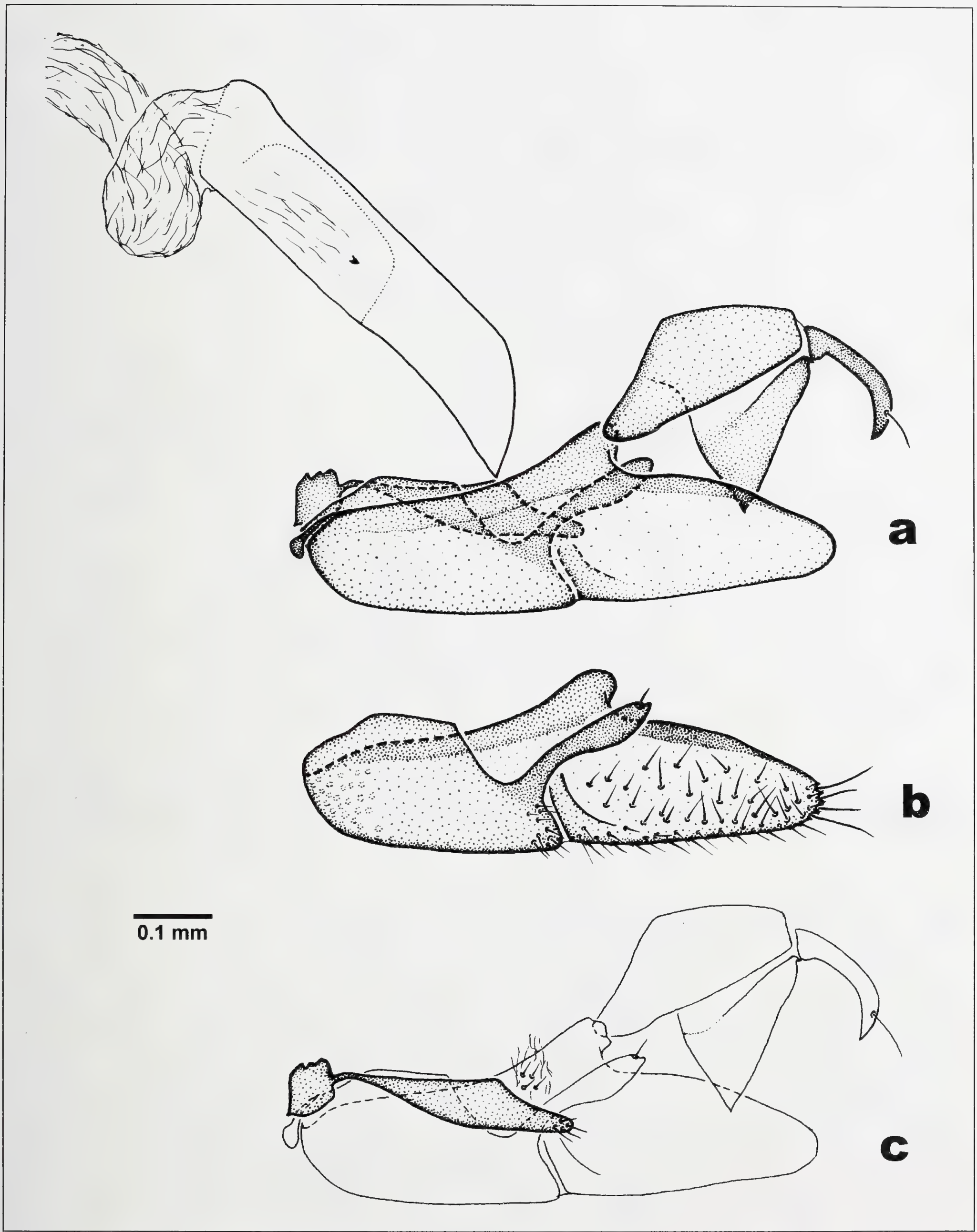


Fig. 16. ♂ genitalia of *Epimarptis hiranoi* sp. n. in lateral view (paratype from Fujihara-dam). a: Whole genitalia. b: Right valva viewed from left side. c: Juxta and setae on diaphragma.

♀ genitalia (Figs. 18–20). Papillae anales weakly sclerotised, ornamented with setae except on dorsal surface. Apophyses of equal length; apophysis anterioris composed of two branches apically fused, one branch derived from tergite, other from sternite (Fig. 20a). Eighth tergite (Figs. 19b, 20) sclerotised moderately, with several

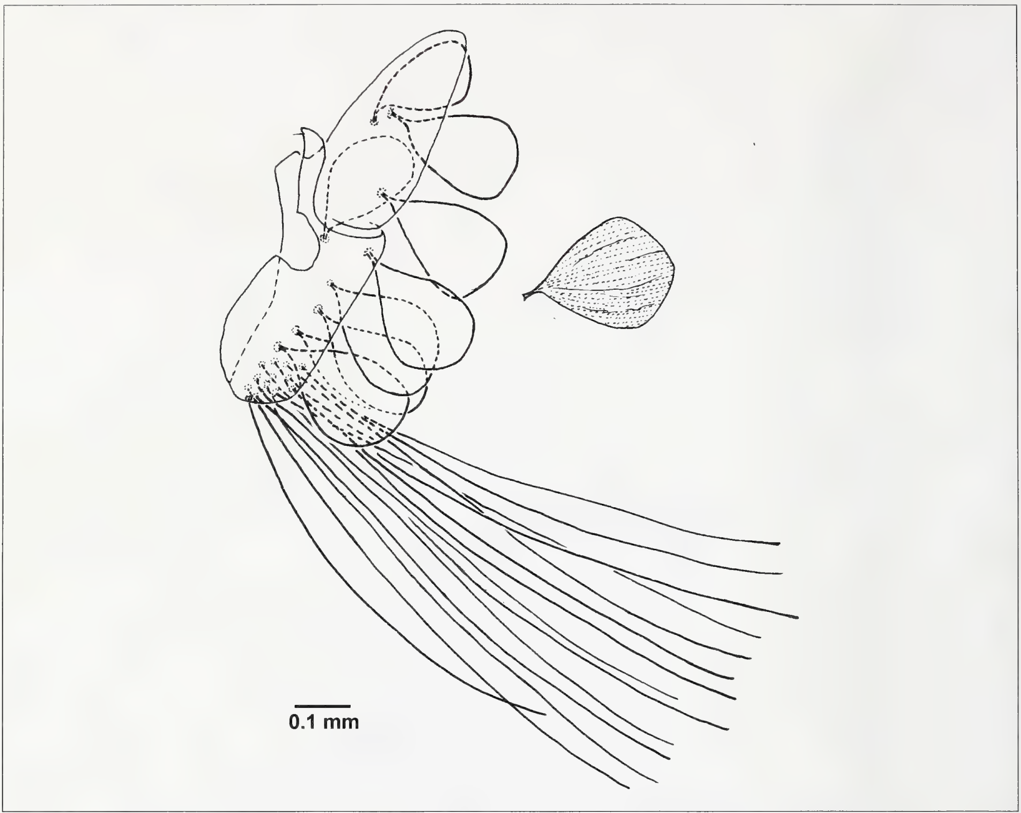


Fig. 17. Vestiture on the outer surface of right valva; diagram based on slides 0534 (paratype from Ohkuchi-zawa) and 1295 (paratype from Ookuti-zawa) of K. Sugisima.

setae of variable lengths along caudal margin; eighth sternite (Figs. 19a, 20) sclerotised strongly, finely spined, finely wrinkled, protruding over ninth sternite, with a pair of groups of setae of various lengths. Antrum a concavity from caudal part of seventh sternite to cephalic part of eighth sternite, weakly sclerotised except for caudal part; caudal wall strongly sclerotised, with paired indentations ventrally covered by cephalic part of eighth sternite, which gives the impression that the eighth sternite in ventral view has a round M-shaped rim near its cephalic margin (compare Figs. 19a and 20b). Colliculum (Figs. 19a, 20a) short, becoming wider cephalically, sclerotised moderately. Ductus bursae (Fig. 18) considerably long, nearly 20 times as long as apophyses posteriores, somewhat becoming wider near corpus bursae. Ductus seminalis (Figs. 19a, 20a) branching off from ductus bursae just cephalically from colliculum; corpus bursae (Fig. 18) ellipsoidal, with signum a keel-like plate.

Diagnosis. *Epimarptis hiranoi* sp. n. has three congeneric species as mentioned in the introduction. Both in size and colouration, *E. hiranoi* is most similar to *E. philocoma*, the type species. In the type species, the triangular dark patch at 2/5 of the forewing is dark brownish inwards and gradually becomes purplish outwards, while the corresponding marking of the new species does not have such a gradation. The new species

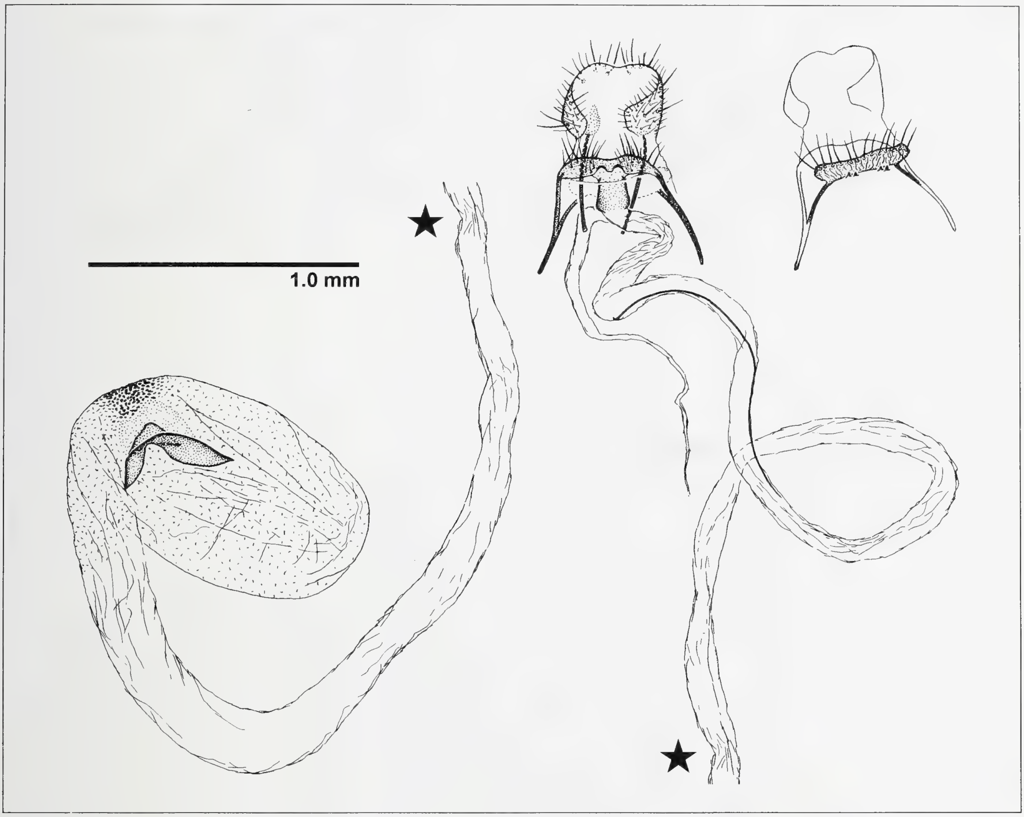


Fig. 18. ♀ genitalia of *Epimarptis hiranoi* sp. n. in standard position (paratype from Kamasawa, slide no. 0911 of K. Sugisima). Stars indicate the same position.

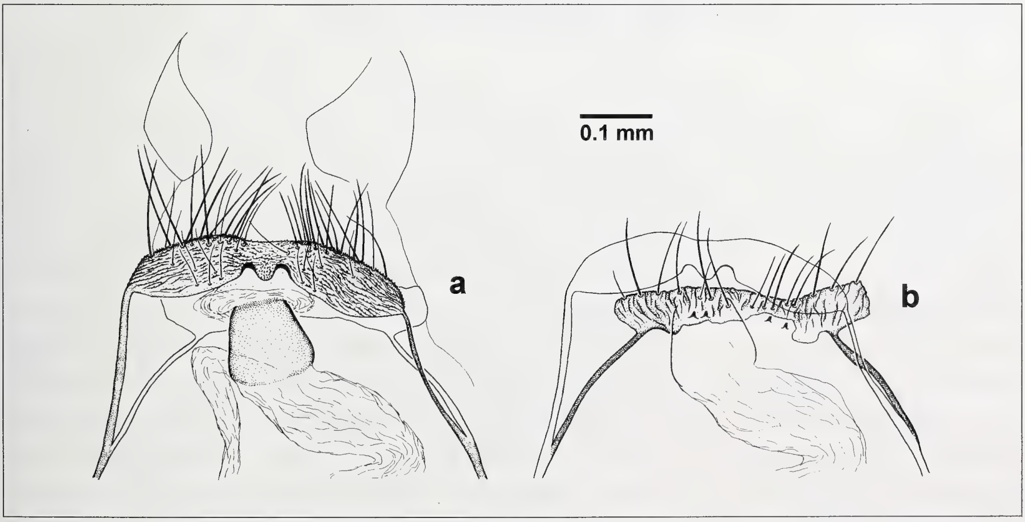


Fig. 19. ♀ genitalia of *Epimarptis hiranoi* sp. n., structures of area around eighth segment (paratype from Kamasawa, slide no. 0911 of K. Sugisima). **a:** Eighth sternite, antrum, and ductus seminalis. **b:** Eighth tergite.

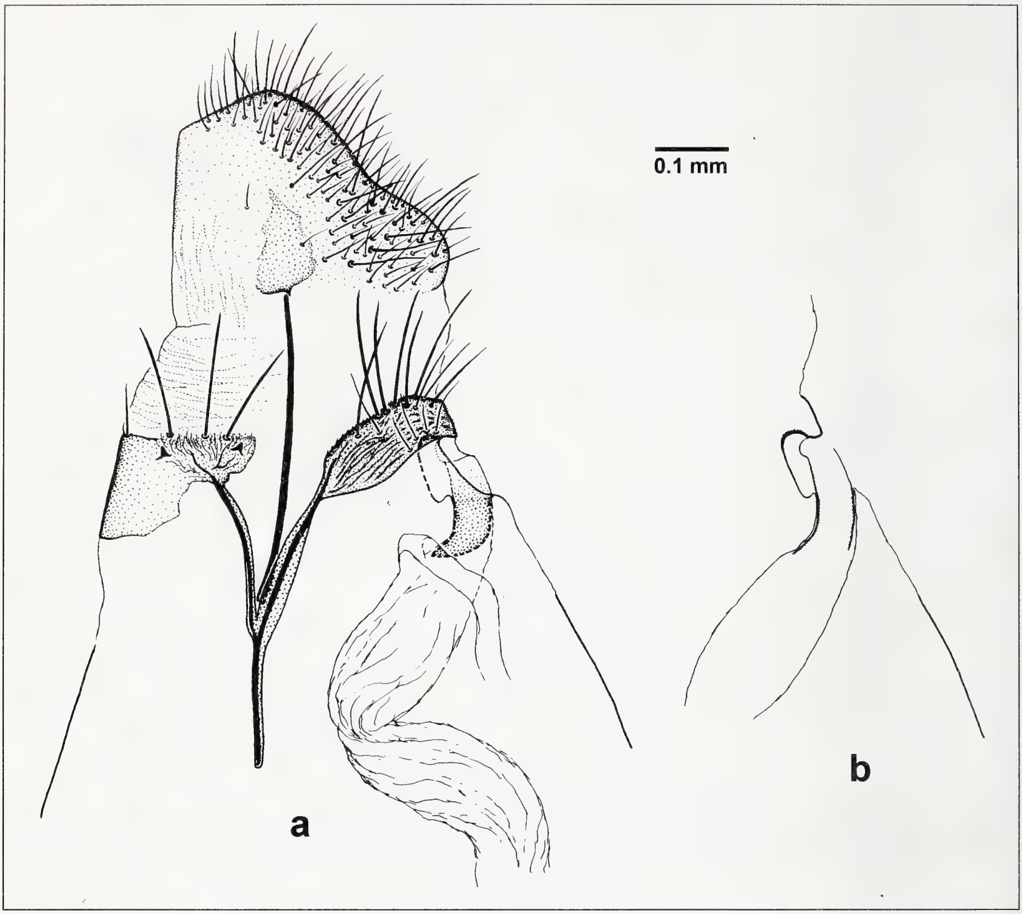


Fig. 20. ♀ genitalia of *Epimarptis hiranoi* sp. n. in lateral view (paratype from Inekoki, slide no. 0944 of K. Sugisima). a: Caudal part. b: Section along median line around ostium.

has only two M-veins in the forewing while the type species has three. In addition, there are some differences in their male genitalia. In the new species, the caudal area of the inner surface of the valva is as long as the cephalic area, the caudal projections of the juxta are separated by a length equal to the width of their bases, and the largest cornutus is at most a small conical sclerite. In the type species, the caudal area of the inner surface of the valva is 1.5 times as long as the cephalic area, the caudal projections of the juxta are closer to each other than in the new species, and the largest cornutus is C-shaped and much larger than in the new species. *E. hiranoi* can be separated from the other two congeneric species more easily. *E. septicodes* has dark brownish forewings and a greyish body, thus appearing much darker than the new species. *E. isoloxa* is 15–16 mm in wingspan and at a glance much larger than the new species. In colouration, the orange brownish area of the forewings is less distinct in *E. isoloxa* than in the new species.

Derivatio nominis. The specific name honours Mr Nagao Hirano, who provided many specimens and helped me in collecting others.
Life history. The immature stages are unknown. All moths were collected at light traps from mid June until late July. At Ôkuchi-zawa, Toyoshina, Nagano Pref., a total of 4♂, 3♀ were collected, and the collection dates range from June 10 to July 19, with a presumed peak in the second quarter of July.
Distribution. Japan, Honshû.

Discussion

Based on a fairly thorough cladistic analysis within Gelechioidea, Kaila (2004) suggested that Coleophoridae should be expanded to include *Coelopoeta*, *Stathmopoda*, those genera formerly placed in Batrachedrinae of Hodges (1998) and the traditional coleophorids which mainly comprise *Coleophora* Hübner, 1822. The monophyly of his expanded Coleophoridae is supported by four characters: epinotum without median ridge; male retinaculum directly from Rs; hindwing without stem of M1 + M2 in cell; and hindwing costa with long stout scales. These characters are more or less homoplastic when Gelechioidea as a whole are considered, and only the two hindwing characters are present in *Epimarptis hiranoi*. Nevertheless, according to Kaila (2004), *Epimarptis* constantly fell in his Coleophoridae clade. In his analysis, *Epimarptis* shows numerous missing entries. Thus a comparison of important morphological features for *Epimarptis* and other coleophorid genera, including the observations of the present study may provide some light on the phylogenetic position of *Epimarptis*. This comparison is presented below. It takes into account information on the morphology of the following genera of the expanded Coleophoridae: *Batrachedra* Herrich-Schäffer, 1853, *Coelopoeta*, *Coleophora*, *Goniodoma* Zeller, 1849, *Homaledra* Busck, 1900, *Idioglossa* Walsingham, 1881, and *Stathmopoda* Herrich-Schäffer, 1853. Information on other coleophorid genera was obtained from Kaila (2004) and Sugisima and Arita (2000).
In *E. hiranoi*, the notch and covering tooth of the male antenna are present on the ventral side and are due to a modification of the third segment (Figs. 1b, 3). In the other coleophorid genera, similar structures are known in *Idioglossa*. However, the structures of *Idioglossa* are due to a modification of the fourth or fifth segment. The male antennal notch and covering tooth in *Epimarptis* and *Idioglossa* can be homoplastic. Minet (1990) regarded the antennal notch in *Epimarptis* as being related to that of some Blastobasidae, but the notch in the latter taxa is on the dorsal side and is not likely to be homologous with that of *Epimarptis*.
The maxillary palpus of *E. hiranoi* (Fig. 4) is five-segmented while this organ has not been examined in other *Epimarptis* species. The five-segmented maxillary palpus has not been reported in any other gelechioids. The ancestral condition of the maxillary palpus in Gelechioidea is considered to be four-segmented, and the five-segmented condition is probably a reversal. In the other coleophorid genera studied here, it is composed of four or fewer segments.

In wing venation *E. hiranoi* (Figs. 5, 6) is different from other coleophorid genera. In the forewing of *E. hiranoi*, the Radial vein has five branches and R5 reaches the termen. *Batrachedra*, *Coleophora*, and *Homaledra* lack R5. In other coleophorid genera the Radial vein has five branches and R5 reaches the costa. The forewing cell of *E. hiranoi* is almost closed basally; this character is rare in Gelechioidea and can be a generic diagnostic feature. The hindwing venation of *E. hiranoi* is the same as that of *E. philocoma* (see Hodges 1998: fig. 9.6N). Without any apparent analysis Hodges (1998) considered that the caudal branch of Rs in *E. philocoma* is a fused vein M1+2 and three branches arising from the CuA-stem as M3, CuA1, and CuA2. However, it seems to be impossible to discriminate the fusion of M1 and M2 from the loss of one of the three M-branches unless the ancestral condition is determined. In *Batrachedra* and *Homaledra* M1 and M2 are stalked and their common stem arises from Rs. In *Coelopoeta*, all three M-branches are present, with M2 and M3 stalked; this venation seems hardly related to that of *Epimarptis*. In *Coleophora*, two M-veins are recognised as in *Epimarptis*, but the posterior one is neither stalked with Rs nor with the CuA-stem. In *Idioglossa*, the branching pattern of the veins is the same as in *E. hiranoi*, but Rs reaches the termen instead of the costa. The hindwing of *Stathmopoda* has all veins, with M1 stalked with Rs, and with M2 and M3 arising from the CuA-stem.

The fore leg of *E. hiranoi* (Fig. 9) lacks the epiphysis on the tibia. The absence of epiphysis is sometimes observed in *Coleophora*, where the epiphysis tends to be vestigial. In other coleophorid genera, the epiphysis is well-developed.

In *E. hiranoi*, the cephalic margin of the metascutellum (Figs. 10, 11a) is evenly rounded and lacks distinct corners. In addition, the margin of the infraepisternum (Fig. 11b) has a weakly sclerotised part medio-caudally. In other coleophorid genera, the metascutellum has distinct cephalo-lateral corners and the infraepisternum is strongly sclerotised along the entire margin.

The ventral element of the abdominal supporting system of *E. hiranoi* (Fig. 13a) is composed of a strongly sclerotised sub-pentagonal area, a pair of short apodemes, and a pair of indistinct venulae. *Coelopoeta*, *Idioglossa*, *Stathmopoda*, and the traditional coleophorids are similar to *E. hiranoi*, but they have no or little-developed apodemes. *Batrachedra* and *Homaledra* are sexually dimorphic: in addition to the strongly sclerotised area, the male has distinct venulae while the female has long pointed apodemes and distinct venulae.

The male of *E. hiranoi* has the eighth sternite strongly sclerotised with a pair of apophyses (Fig. 13b). The same condition is observed in *Batrachedra* and *Idioglossa* (Sugisima & Arita 2000; Sugisima, unpubl.). According to L. Kaila (pers. commn), the apophyses of the male eighth sternite of *Homaledra* are not so distinct, and other coleophorid genera have a non-specialized eighth sternite.

In *E. hiranoi*, the second to seventh abdominal tergites have a pair of patches of spine-like scales (Fig. 13) and the male genitalia have the gnathos articulated with the tegumen (Figs. 15a, 16a); these are the defining characters of Batrachedridae of Hodges (1998). However, these character states need further examination. The spine-like scales are arranged in paired patches in the traditional coleophorid genera as well as in the Batrachedridae of Hodges (1998). On the other hand, Kaila (2004) coded the spine-like scales of *Homaledra*, which was placed in Batrachedridae by Hodges (1998), as being arranged in a single patch. Moreover, *Stathmopoda haematosema* Meyrick, 1933 has the patch of spine-like scales arranged in an upside down paired "T" (Sugisima, unpubl.). This species appears to have the gnathos articulated with the tegumen rather than fused with it. These characters in *S. haematosema* show that the arrangement of spine-like scales and the articulation of the gnathos can be homoplastic in the clade of expanded Coleophoridae.

In the female genitalia of *E. hiranoi* (Figs. 18–20) the apophyses anteriores are composed of two apically fused branches, one arising from the eighth tergite and the other from the eighth sternite. The same structure is observed also in *Batrachedra* and *Homaledra*. Other coleophorid genera, except for *Idioglossa*, have the apophyses anteriores arising from the eighth tergite. In general, the apophyses anteriores originate from the eighth tergite. On the other hand, that structure in *Idioglossa* arises from the eighth sternite and it seems reasonable to consider that this condition is due to a loss of the tergite-branch from the condition observed in *Epimarptis*.

Based on the above observations the characters of *Epimarptis* show a rather mosaic pattern and it seems impossible to make any conclusions about its position within the coleophorid clade. The eighth sternite of the male abdomen and the apophyses anteriores of the female genitalia may suggest close affinities between *Epimarptis* and the Batrachedridae of Hodges (1998). The same affinities could be supported by the spine-like scales and the articulation of the gnathos, but these conditions may be homoplastic. In contrast, the absence of the epiphysis on the fore tibia suggests affinities between *Epimarptis* and the traditional coleophorids rather than the Batrachedridae of Hodges (1998). The characters of the wing venation and thoracic skeleton do not support any particular affinities, or even contradict the view that *Epimarptis* belongs to the Coleophoridae clade. In order to settle this contradiction, as stated by Kaila (2004: 321), it would be desirable to add more taxa and to reduce the number of missing entries into the analysis, especially with regard to the immature stages. As far as the present knowledge is concerned, *Epimarptis* seems to be rather uniform in morphology. Further discovery of undescribed species of *Epimarptis* is desired because they may possess intermediate characters between described *Epimarptis* species and some other gelechioids.

As mentioned in the introduction, there are no records of *Epimarptis* from Southeast Asia. It is not appropriate to regard a lack of research in this region as an explanation for this disjunction in distribution. Several expeditions for collecting micromoths, mainly by European and Japanese institutes, have been to Southeast Asia during recent decades. Judging from the habits of *E. hiranoi*, moths of *Epimarptis* are likely to be collected at light-traps. A more conceivable reason is that a shortage of information on the genus has kept many *Epimarptis* specimens remaining to be recognised in museum collections. This paper will hopefully lead to the discovery of many specimens of the genus in various micromoth collections from Southeast Asia.

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The *Elachista juliensis* complex revisited (Elachistidae)

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Abstract. The taxonomy of the *Elachista juliensis* complex is revised on the basis of extensive samples, including ex ovo series. Four species are considered to be valid: 1. *Elachista juliensis* Frey, 1870, (= *E. freyi* Staudinger, 1870 **syn. rev.**, *E. klimeschi* (Traugott-Olsen, 1994) **syn. rev.**, *E. ingeborgae* (Traugott-Olsen, 1994) **syn. n.**), 2. *Elachista occidentalis* Frey, 1882 (= *E. buvati* (Traugott-Olsen, 1994) **syn. n.**, *E. ruthae* (Traugott-Olsen, 1994) **syn. n.**), 3. *Elachista zonulae* Sruoga, 1990, and 4. *Elachista ribentella* **sp. n.** *E. juliensis* is distributed in Central Europe and seems confined to *Carex humilis*. *E. occidentalis* is widespread throughout Europe. It feeds on *Carex digitata* and *C. ericetorum*. *E. zonulae* is recorded from the Alps, Tatra Mts., Tian Shan Mts. in Kazakhstan, Kyrgyzstan and Tajikistan, and Altai Mts. in Siberia. It has been reared from *Carex sempervirens*. *E. ribentella* is recorded from Japan and the Russian Far East. Its host plant is *Carex blepharicarpa*.

Key words. Elachistidae, Elachistinae, *Elachista*, taxonomy, synonymy, *Elachista ribentella*, new species, Palaearctic

Introduction

The Elachistinae (Gelechioidea: Elachistidae) comprises numerous small-sized moths characterised by the leaf-mining larval mode of life. The adults are notoriously difficult to identify due to their generally uniform genital morphology. This, in addition to the scarcity of material available for many species, has lead to uncertain species concepts based on vague character evidence. Numerous papers dealing with the taxonomy of European *Elachista* Treitschke, 1833 species have been published during the last decades. These papers are often dedicated to descriptions of single species, not always accompanied with adequate reference to other related or similar species. Many species complexes still await critical treatment with all constituent taxa simultaneously presented.

In this paper the species complex containing *Elachista juliensis* Frey, 1870 and its close allies is revised. These taxa are considered to belong to the genus *Elachista* following the generic revision by Kaila (1999). This complex has caused problems in identification for a long time. Spuler ([1903]–1910) confused the species *Elachista serricornis* Stainton, 1854 and *Elachista freyi* Staudinger, 1870. In subsequent literature the former species was often called *E. mitterbergeri* Rebel, 1906 and the latter *E. serricornis*. This error still persists in the literature as confusion of the host plant records of these taxa in Traugott-Olsen & Schmidt Nielsen (1977), repeated by Parenti and Varalda (1994), but see Buhl et al. (1991). Parenti (1977) designated the lectotypes of *Elachista juliensis* and *E. occidentalis* Frey, 1882 and considered them conspecific, but did not mention *E. freyi* in this context. Traugott-Olsen & Schmidt Nielsen (1977) designated the lectotype of *E. freyi*, without mention of *E juliensis*. Sruoga (1992) described the closely related *E. zonulae* from mountains of Central Asia, and Kaila (1992) supplemented the description by describing the female of this species, based on one specimen in bad condition.

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Traugott-Olsen (1994) attempted to clarify the situation where the identity and possible conspecifity of *E. juliensis*, *E. freyi*, and *E. occidentalis* had not been properly investigated. This paper is the most comprehensive treatment of this species complex. Unfortunately, its many errors and uncritical treatment of supposed differences between taxa weaken its uselfulness. The identity of *E. juliensis*, i.e. the oldest name available in this complex, was not based on the lectotype and was misunderstood. Likewise, the illustrations representing *E. occidentalis* actually depict *E. juliensis*. The existence of *E. zonulae* (Sruoga, 1992) was overlooked although its male genitalia were illustrated in connection with the description of *Biselachista buvati* Traugott-Olsen, 1994 (cf. Liška 1998; Tokár et al. 1999; Baran 2003). Traugott-Olsen (1994) considered *E. juliensis*, *E. freyi*, and *E. occidentalis* to be valid species, and described four additional species as new in this complex. In the absence of identification keys or proper diagnoses the reader was left with few tools to identify any specimens of this complex. The problem is particularly severe because the suggested differences between the supposed species are tiny. In specific differences the emphasis was placed on wing venation characters for which the utility in species delimitation was found worthless by Albrecht & Kaila (1997), and genitalic characters such as the shape of the vinculum which seems to be one of the intraspecifically most variable and least reliable trait in the male genitalia of *Elachista*. The genital illustrations of Traugott-Olsen (1994) are not quite accurate either (some detailed discussion is given below): some genital illustrations were not drawn from primary types and in the case of *E. buvati* the male genitalia illustrations do not represent the same species as the description.

A closer scrutiny of the variation of the taxa involved suggests that the range of individual variation in populations easily exceeds the specific differences as suggested by Traugott-Olsen (1994). Thus, many, if not most specimens do not fit well any of these descriptions. There are extensive samples of this species complex in many collections that at present cannot be reliably identified, leading to haphazard distribution records based on educated guesses at best. Each specialist seems to have adopted a personal opinion about the validity and delimitation of the species which means that identifications made by different specialists are not fully comparable. It was therefore considered necessary to revise this complex again, but with an emphasis on the estimation of the nature and range of the intraspecific variation. For that purpose, we include photographic illustrations of the primary types involved and extensive samples from all over the Palaearctic region. The limits of species were established and the type specimens of each nominal species were examined in order to find the correct names for each valid species.

As a result, four species are considered to be valid. In Europe, three species occur: *Elachista juliensis*, *E. occidentalis*, and *E. zonulae*. The two first are somewhat variable and considered distinct on the basis of constant differences in the length of the labial palpus and in the shape of the female antrum, supplemented by other strongly correlated yet more variable characteristics: their forewing pattern, the size and differences in the colour of the head, and characteristics of the male genitalia, especially in the size and shape of the uncus. *E. zonulae* is more distinctive, always identifiable by both external appearance and genitalia. The fourth species, *Elachista ribentella* sp. n., occurs in Japan and the Russian Far East. Its status as a distinct species is based on its thicker flagellum of the antenna, shorter aedeagus with longer cornutus than in other species, and slight differences in the external appearance.

Material was received from the following collections:

BMNH	The Natural History Museum, London, U.K. (K. R. Tuck),
MNHB	Museum für Naturkunde, Humboldt-Universität Berlin, Germany (W. Mey),
SEHU	Laboratory of Systematic Entomology, Faculty of Agriculture, Hokkaido University, Japan (K. Sugisima),
TLMF	Tiroler Landesmuseum Ferdinandeum, Innsbruck, Austria (P. Huemer),
MZLU	Museum of Zoology, Lund University, Sweden (R. Danielsson),
MZH	Zoological Museum, Finnish Museum of Natural History, University of Helsinki, Finland (L. Kaila),
ZMUC	Zoological Museum, University of Copenhagen, Denmark (O. Karsholt),
ZSM	Zoologische Staatssammlung, Munich, Germany (A. Segerer),
ZMUO	Zoological Museum, University of Oulu, Finland (J. Itämies),

and the private collections of G. Baldizzone (Asti, Italy), P. Grotenfelt (Kauniainen, Finland), J. Junnilainen (Vantaa, Finland), J. Kaitila (Vantaa, Finland), T. & K. Nupponen (Espoo, Finland), and P. G. Varalda (Morano, Italy).

In the material sections, rearing records by Varalda are indicated and refer to his rearing recording archive. The codes are indicated as, e.g. "rearing A.167".

Diagnosis of the *Elachista juliensis* complex

The members of the *Elachista juliensis* complex belong to the *E. tetragonella* (Herrich-Schäffer, 1855) group as defined by Kaila (1996 and 1999). Within the *E. tetragonella* group these species belong to a subgroup that is characterised by a bilobed mesal knob of the gnathos (= the genus *Biselachista* of Traugott-Olsen & Schmidt Nielsen, 1977). In this subgroup the representatives of the *E. juliensis* complex are not known to share any obvious synapomorphies, but they can be characterised by their dark grey to brown forewing ground colour lacking metallic sheen, combined with the non-serrate flagellum of the antenna, the slender shapes of the aedeagus and digitate process, the slightly longer than wide uncus lobes, and the cornutus of the aedeagus being a weak simple rod. Like most other species of the *E. tetragonella* group, the species of the *E. juliensis* complex feed on *Carex* (Cyperaceae). They seem to show high fidelity to certain *Carex* species, which may help in the field identification of the species.

Identification of the species of the *Elachista juliensis* complex

Elachista juliensis, *E. occidentalis*, and *E. ribentella* are all morphologically close to each other, while *E. zonulae* differs in several ways, bearing resemblance with *E. serricornis* with respect to some traits. *E. occidentalis* is the largest of the species and its wing pattern is characterised by a black oblique streak that basally delimits the white costal spot. This trait is especially distinctive in paler specimens; the ground colour of *E. occidentalis* varies from dark mottled grey to paler grey and brownish

(Fig. 10). Its labial palpi are longer than those of *E. juliensis*. *E. ribentella* externally resembles particularly mottled grey specimens of *E. occidentalis*, and they both also have a more or less white head. *E. ribentella* is slightly more broad-winged and the pale pattern of the male is indistinct, all spots being suffused by dark-tipped scales (Fig. 19). The flagellum of the male antenna is thicker and more clearly annulated in *E. ribentella* than in the other species. *E. juliensis* is smaller, its forewing ground colour always dark grey (Fig. 1). The colour of its head varies from unicolorous grey to white. The male genitalia of these three species closely resemble each other. *E. ribentella* differs from the other species by its shorter aedeagus and longer cornutus (compare Figs. 20–22). Its distal fold of the costa is also more pronounced, and usually distinctively broadened distally. The separation of *E. juliensis* from *E. occidentalis* using male genitalia is usually possible by the longer uncus lobes of *E. occidentalis*, and by its slightly more slender valva, digitate process, and aedeagus (cf. Figs. 4–8, 12–15). This difference seems not to be caused by allometry due to the generally larger size of *E. occidentalis*, as these characters do not display intraspecific trends that would correlate with their size. The female antrum is the most straightforward character to distinguish between *E. juliensis* and *E. occidentalis*: it is distinctly broader than deep in *E. juliensis* while it is as broad as deep in *E. occidentalis* (Fig. 18). The antrum shape of *E. ribentella* varies, but it seems to be more strongly armed with spines than in the other species. The shape of the signum is very variable and probably is of little use in identification of any of the species. However, it may be that the teeth are somewhat stouter in *E. occidentalis* than in *E. juliensis* (Fig. 17). *E. zonulae* is externally characterised by its invariably grey head and the costal and tornal spots of the forewing being situated opposite to each other, as in *E. humilis* Zeller, 1850 (Fig. 24). Its male genitalia are characterised by the narrow and long uncus lobes separated by a broad incision, the valva with the cucullus only weakly twisted on top of the costa, and the basally strongly bent aedeagus (Figs. 25, 26). The female genitalia differ from those of the other species by the smaller antrum (Fig. 18).

Elachista juliensis (Figs. 1–9, 17–18)

Elachista juliensis Frey, 1870: 279, *nec* Traugott-Olsen (1994)
Elachista freyi Staudinger, 1870: 322, **syn rev.**
Biselachista klimeschi Traugott-Olsen, 1994: 326, *nec* Dufrane, 1957, **syn rev.**
Biselachista ingeborgae Traugott-Olsen, 1994: 332, **syn. n.**
Biselachista occidentalis sensu Traugott-Olsen, 1994, nec Frey, 1882 (partim)

Material. Lectotype ♂ of *Elachista juliensis*, labelled: LECTO- / TYPE [rounded with blue margin]; *E. juliensis.* / Frey / Engadin; Frey coll. / Brit. Mus. / 1890-62; B. M. ♂ /Genitalia slide /No. 1932; LectoTYPUS ♂ / *Elachista* / *juliensis* / Frey / TESTE U. PARENTI 1976. (BMNH). Lectotype of *Elachista freyi*, labelled: 29/7; Macugnago m.; Origin.; *freyi* Stdgr; Genital praeparat nr. 1984 sex ♂ E. Traugott-Olsen, LECTOTYPE; Zool. Mus. Berlin (MNHB). Paralectotype slides: ♀, U. Parenti 82, 9519 (MNHB); ♂, teste Hering No. 608/1941 (MNHB). Holotype of *Biselachista klimeschi*, labelled: Holotype; Genital praeparat nr. 6433 sex: ♂; E. Traugott-Olsen; Wing praeparat nr. 6434 sex: ♂ E. Traugott-Olsen; Carinthia, H. Blut Tauernbg. 1800 m 14.8.1973 Klimesch; *Biselachista klimeschi* sp. n. det. E. Traugott-Olsen; coll. E. Traugott-Olsen; coll. ZMUC Copenhagen Denmark. Paratypes 2♂ with the same collection data (1♂ in ZMUC, 1♂ in ZSM with slide LK 3744). Type series of *Biselachista ingeborgae* (see remarks below): **1)** pin with holotype label, with two male specimens of which one lacks right wing pair and the other is without adomen, labelled: Holotype; Genital praeparat r. 6438 sex ♂ E. Traugott-Olsen; Wing praeparat nr. 6439 sex ♂ E. Traugott-Olsen; Trentino Val Sarca Pietramurata,

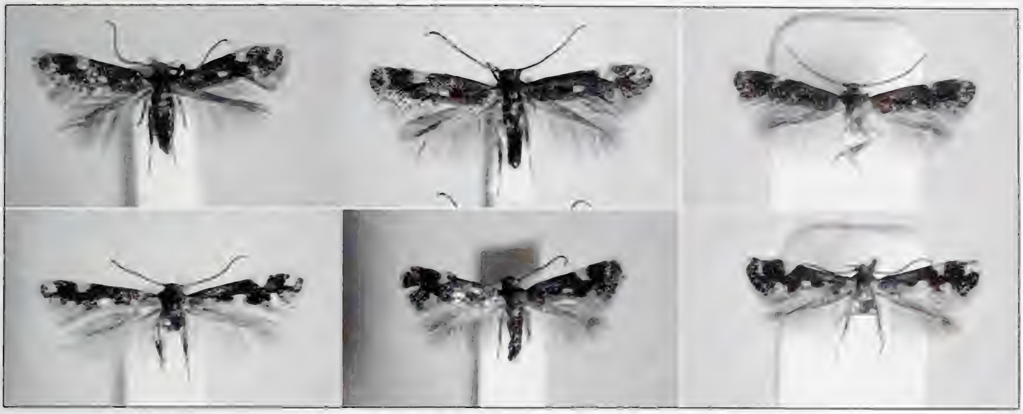


Fig. 1. Habitus of *Elachista juliensis*. Top row: males, bottom row females. Top left: Austria, Carinthia, Rossbach, Hl. Blut, 1700 m, 10.viii.1969, Klimesch leg. (ZSM). Top middle: Austria superior, Warscheneck, 1700 m, 8.viii.1937, Klimesch leg. (ZSM). Top right: Italy, V. d'Aosta, Aymavilles, frazione Ozein, 1250 m, ex ovo A. 131 1993, Varalda leg. et coll.. Bottom left: Austria, Carinthia Hl. Blut Tauernbg., 1800 m, 16.viii.1974, Klimesch leg. (ZSM). Bottom middle: Austria, Wien, Leopoldsberg, 5.vii.1942, Preissecker leg. (ZSM). Bottom right: Italy, Piemonte, Chiusa San Michele (TO), Sacra S. Mich., 850 m, ex ovo A. 193 1994, Varalda leg. et coll.

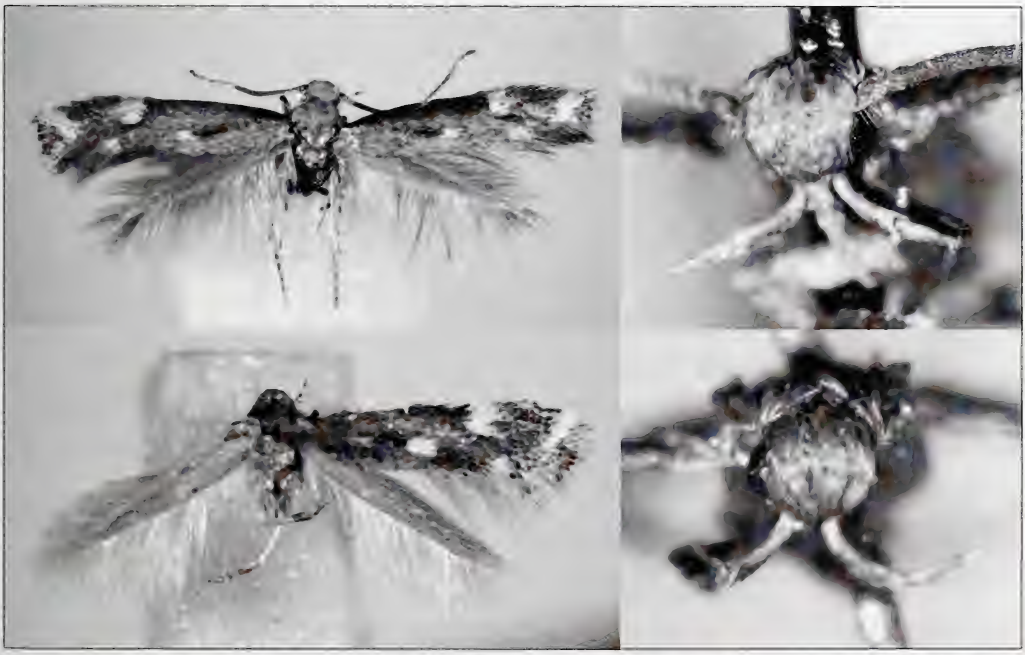


Fig. 2. Habitus and head of the primary types of taxa here considered conspecific with *Elachista juliensis*. Top: lectotype of *Elachista juliensis*. Bottom: lectotype of *Elachista freyi*.

m 250, nei boschi 28.vi.59 E. Jäckh; *Biselachista ingeae* sp. n. det. E. Traugott-Olsen; *Biselachista ingeborgae* sp. n. det. E. Traugott-Olsen; coll. E. Traugott-Olsen; coll. ZMUC Copenhagen Denmark. **2)** pin with paratype label containing two male specimens, one without abdomen, with preparation label 'Genital praeparat nr. 6446 sex: ♂; E. Traugott-Olsen'; otherwise with the same labeling as the holotype pin. **Austria:** 1♂ Austria inf., Dürnstein, 14.vii.1938, Klimesch leg. [in a pin together with a ♀ *Elachista*

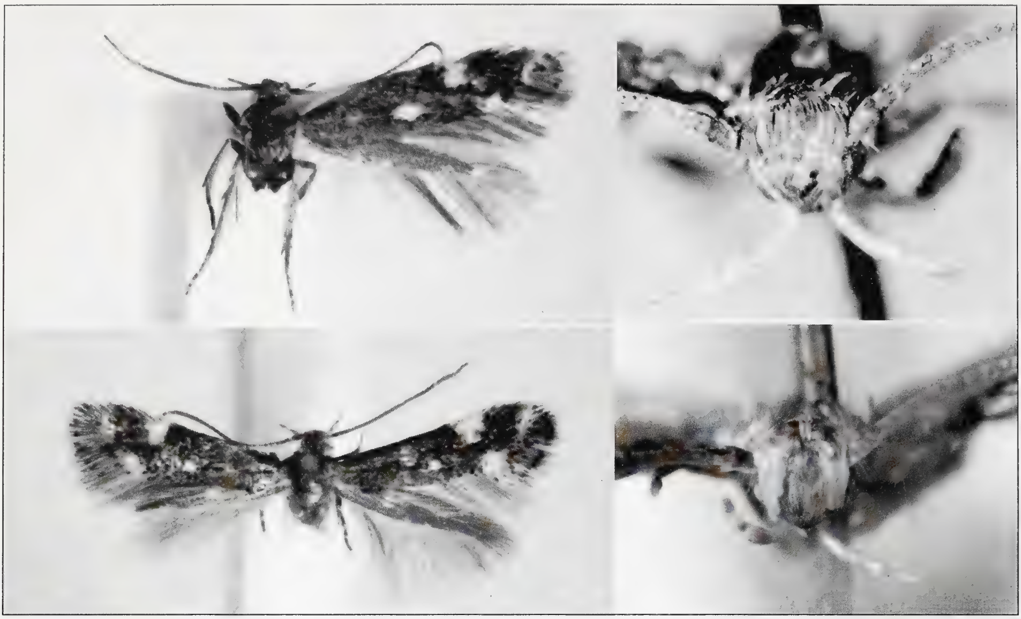
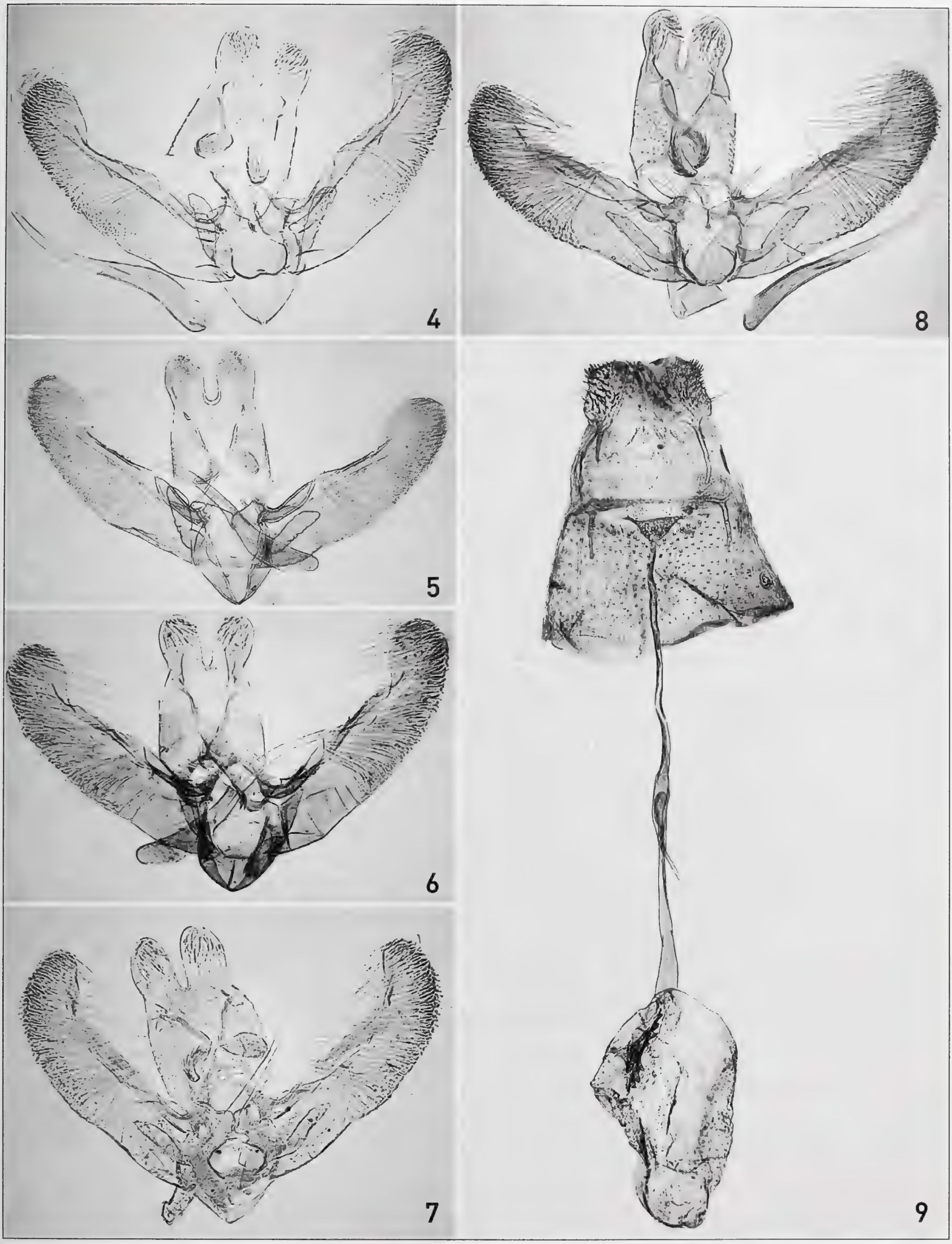


Fig. 3. Habitus and head of the primary types of taxa here considered synonyms of *Elachista juliensis* Frey. Top: holotype of *Biselachista klimeschi*. Bottom: holotype of *Biselachista ingeborgae*.

martinii Her.] (LK slide 3772 *juliensis*, 3773 *martinii*, ZSM). 1♀ same data, but 18.vi.1938 (e. l. ex *Carex humilis*), Klimesch leg., with identification label "*Biselachista occidentalis* Frey det. E. Traugott-Olsen", Akvarel E. Traugott-Olsen (ETO slide 1782, ZMUC). 3♂ Austria superior, Klaus, 4.viii.1937, 19.vi.1946, Klimesch leg. (slide IS 4235) (MZLU). 1♂ Austria superior, Hinterstoder, 14.vii.1938, Klimesch leg. (LK slide 3774, ZSM). 2♂ Austria superior, Warscheneck, 1700 m, 8.viii.1937, [collector not mentioned] (ZSM). 2♂ Carinthia, H. Blut Tauernbg., 1800 m, 16.8.1974, Klimesch leg. (ETO slide 6536, ZMUC, 1♂ in ZSM); 5♂ same data, but 13.–14.viii.1973 (LK slides 3190, 3734, 3735, MZH). 1♂ Carinthia, Rossbach Hl. Blut., 1700 m, 10.viii.1969, Klimesch leg. (ZSM). 2♂ Teriolis sept. Innsbruck 18.vii.1941, 19.vii.1942, Klimesch leg. (TLMF). 2♂ Teriolis, Brenner Vennatal, 1400 m, 27.vii.1947, Klimesch leg. (ZSM). 1♀ Wien, Leopoldsberg 5.vii.1942 (e. l. ex *Carex* sp.), Preissecker leg. (ZSM). **Germany:** 1♂ Thuringia, Blankenburg, 21.vii.1970, Steuer leg., with identification label "*Biselachista occidentalis* Frey det. E. Traugott-Olsen" (LK slide 3771, ZSM). 1♂, 1♀ Blankenburg, Muschelkalk, 4.viii.1968 (ETO slide ♀ 5201, LK slide ♂ 3739); 1♀, same data, but 2.vii.1978 (e. l. ex *Carex humilis*), Steuer leg. (ZMUC); 1♂, same data, but 26.vii.1978 (e. l. ex *Carex humilis*) with identification label "*Biselachista occidentalis* Frey det. E. Traugott-Olsen" (ZSM). 2♂ Regensburg, 17.vii.1899, 19.vii.1900 (ex *Carex humilis*), coll. Frank, coll. Osthelder, with identification label "*Elachista juliensis* det. Kolbeck" (LK slide 3737, Kolbeck slide 18671/96, ZSM). **Italy:** 1♂, 1♀ Italy, Piemonte, Chiusa San Michele (TO), Sacra S. Mich., 850 m, rearing A.167, 5.–10.vii.1994 (ex *Carex humilis*); 13♂ 14♀, same data, but rearing A. 168, 18.vi.–10.vii.1994 (ex *Carex humilis*), Varalda leg. et coll. (slides LK 3847–3856, 3881–3890); 6♂ 3♀ rearing A. 193, 12.vi.–5.vii.1994 (ex *Carex humilis*), Varalda leg. et coll. (slide Varalda 0164). 1♂ 1♀ Piemonte, Ovada (Alessandria), per Gnocchetto, 260 m, rearing A. 152, 3.–13.vii.1994 (ex *Carex humilis*), Varalda leg. et coll. 1♂ Piemonte, Mt. Rocciamelone (TO) Mompantero-Riposa, 1100 m, rearing A. 138, 3.vii.1993 (ex *Carex humilis*), Varalda leg. et coll. 5♂, Piemonte (CN) Parco Natur. Reg. Alpi Maritime, Valdieri, Riserva Natur. Speciale dello *Juniperus phoenicea*, 900 m, 18., 22.vii.1998, Baldizzone leg., with identification label "*Biselachista freyi* Stgr. det. E. Traugott-Olsen", (ETO slide 6597, LK slide 3736, ZMUC); 8♂ 3♀ 17.vii.1999, 17., 20., 14.–27.vii.2000, Baldizzone leg., all with identification label "*Biselachista juliensis* P. G. Varalda det." (coll. Baldizzone); 43, 7♀ same data, but 13., 18., 22.vii.1998, 11.vi., 10.vii., 12., 17.vii.1999, Baldizzone leg., all with identification label "*Biselachista freyi* Stgr. det. E. Traugott-Olsen" (coll. Baldizzone). 16♂ Piemonte (CN) Parco Natur. Reg. Alpi Maritime, Palanfré – loc. Pascariund, 1450 m, 5.viii.2001,



Figs. 4–8. ♂ genitalia of *Elachista juliensis*. **4.** *E. juliensis*, lectotype (BM 19382, BMNH). **5.** Lectotype of *E. freyi* (ETO 1984, MNHB). **6.** Holotype of *Biselachista klimeschi* (ETO B.6.4.93, ZMUC). **7.** Holotype of *Biselachista ingeborgae* (ETO A.10.4.93, ZMUC). **8.** *E. juliensis* from Italy, Piemonte (LK 3851). **9.** ♀ genitalia of *E. juliensis* from Italy, Piemonte, Chiusa San Michele (TO), Sacra S. Mich., 850 m (LK 3882).

Baldizzone leg. et coll. 1♂ Piemonte (CN) Parco Natur. Reg. Alpi Maritime, Monte Ray, 1600–1800 m, 31.vii.2001, Baldizzone leg. et coll. 1♂ Piemonte, Parco Naz. Gr. Paradiso loc. Lago Serrù, 2275 m, 6.viii.1992, Delmastro leg., with identification label "*Biselachista klimeschi* Tr.-O. det. E. Traugott-Olsen" (ETO slide 6536, ZMUC). 1♂ Trentino, Val Sarca colline Lago di Cavedine, 7.viii.1970, Jäckh leg. (ZMUC). 1♂ Trento, 28.vi.1945, Klimesch leg. (LK slide 3191, MZH). 2♂, 3♀ Dintorni Trento 28.vi.1945, vii.1945, Klimesch leg. (MZH, LK slides 3767–3770, ZSM). 4♂ 4♀ V. d'Aosta, Aymavilles (Aosta), frazione Ozein, 1250 m, rearing A. 131, 18.vi.–9.vii.1994 (ex *Carex humilis*), Varalda leg. et coll. (slide Varalda 0162); 1♀ same data, but rearing A. 253, 16.vii.1995 (ex *Carex humilis*), Varalda leg. et coll. 7♂, 10♀ Aymavilles (Aosta), frazione Pondel, 890 m, rearing A. 250, 14.vi.–20.vii.1995 (ex *Carex humilis*), Varalda leg. et coll.

Description. Forewing length ♂ 2.6–3.3 mm, ♀ 2.5–3.0 mm. Male: Labial palpus ascending, length 1.0–1.2 times diameter of head; above white or pale ochreous except base of 3rd segment narrowly grey, below variably powdered with grey. Head varying: frons may be partly or entirely shiny white, head otherwise grey, or whole head unicolorous grey or mottled grey. Neck tuft mottled grey. Thorax mottled grey, scales of tegula and metascutum sometimes whitish, grey-tipped. Forewing ground colour dark grey, with five white markings for which size and brightness vary:
1 – indistinct small white streak basally, often absent, 2 – another more distinct streak distally from black streak situated at fold before middle of wing, 3 – triangular costal spot at distal 2/3 of costa, 4 – small, more or less rounded tornal spot beyond costal spot, and 5 – transverse streak at apex. Fringe scales grey, basal fringe scales black-tipped forming black fringe line. Hindwing grey. Underside of forewing dark grey, fringe at costal and tornal spots creamy white; underside of hindwing grey. Female otherwise as male but forewing with brighter and more expanded white pattern.
Male genitalia. Uncus lobes slightly longer than broad, distally rounded; median incision between them narrow u-shaped. Mesal margin of juxta lobes short, straight, distal margin almost straight, medially with group of long scales; digitate process rather narrow, distally variably oblique and acute-tipped or blunt, tongue-shaped; 0.28–0.30 times as long as valva; valva somewhat bent, width 0.3 times length at widest point; basal and distal fold of costa meet at 1/3 length of valva, distal fold even, sometimes slightly wrinkled; length of cucullus 1/4 of valva, longer than wide, somewhat bent towards costa, distinctly twisted over distal fold of costa. Aedeagus gradually tapered towards apex, 0.80–0.95 times as long as valva, slightly bent S-shaped, caecum as long as basal opening of aedeagus; vesica with indistinctly sclerotised straight narrow cornutus, 0.22–0.24 times as long as aedeagus.
Female genitalia. Papillae anales rounded, covered with long and thin setae, distally also with short and stout setae. Apophyses posteriores stout, rather straight, variable in length to some extent. Apophyses anteriores varying from 2/3 to full length of apophyses posteriores, stout or slender. Ostium bursae occupying half the width between apophyses anteriores, dorsal wall spinose; antrum broader than deep, internally spinose; ductus bursae posteriorly narrow, tubular, broader cephalad from inception point of ductus seminalis; sclerotisation of colliculum long, almost extended from antrum to inception of ductus seminalis; ductus bursae distinct from corpus bursae; corpus bursae largely covered with distinctive internal spines; signum an elongate dentate plate of variable shape.

Life history. *E. juliensis* is univoltine. It seems to be monophagous on *Carex humilis*. The full-grown larva is 4.5–5.0 mm long, faded wax-coloured, with the prothoracic and anal plates almost concolorous with the body with the exception of the distal area of the tergal prothoracic plate which is striking as being melanised. The mine occupies the median part of the leaf; it is thin, 1.0–1.5 mm wide and about 8.5–10.5 cm long. The initial mine, constituting about half the total length of the mine, is very thin and then gradually widens. Towards the end it occupies about half the width of the leaf. Pupation takes place on the base of the leaf in the densely caespitose tussock of the host plant. The pupa is ochreous.

Distribution. Central Europe. Material studied from Austria, Germany, and Italy.

Remarks. According to the orginal description (Traugott-Olsen 1994) the type series of *Biselachista ingeborgae* consists of the male holotype and three male paratypes, all in the E. Traugott-Olsen collection (ETO). The types are stated to be as follows (loc. cit., verbatim): "Holotype male: Italia, Trentino, Val Sacra, Pietramurata, 28-vi-59, leg. E. Jäckh; gen-prep. 6438/ETO; wing prep. 6439/ETO; *Biselachista ingeborgae* sp. n. det. E. Traugott-Olsen. In coll. ETO.. Paratypes: 1) on pin with type, abdomen missing. 2) and 3) on joint pin, same data as type, anterior specimen with gen. prep 6440/ETO. In coll. ETO." In the Traugott-Olsen collection (now in ZMUC) there are four specimens labelled as type material. However, they do not fit the characteristics cited above. On the pin with the holotype label and the preparate labels, containing two specimens, one of the specimens lacks the abdomen and the other a pair of wings. Thus, the genital dissection and the wing preparation were made from different specimens. The slides corresponding to these numbers were not found in the ETO collection. There are, instead, a genital dissection numbered A.10.4.93 and a wing preparation numbered B 4.4.93. The paratype dissection no. 6440 has not been located. Ole Karsholt (pers. comm.) informed us that Traugott-Olsen changed his slide numbering system, but that this change had not been executed consistently. Therefore the existing wing slide almost certainly is the same as mentioned by Traugott-Olsen (1994), and the genital slide is either the holotype or the paratype slide. The male genital drawing of *B. ingeborgae* (Figs. 29, 37 in Traugott-Olsen 1994) generally resembles the genitalia on slide A.10.4.93 (cf. Fig. 7) although the digitate process is more compressed on the slide than on the drawing, and unlike the drawing, the tip of the aedeagus is not bifurcate on the slide. However, the general position of the genitalia drawing, agrees well with the genitalia on the slide. Similar discrepancies can be seen when the authentic genital slide of *Biselachista ruthae* Traugott-Olsen, 1994 (Fig. 13) is compared with Traugott-Olsen's drawing (1994: figs. 27, 35). In this case the digitate processes are drawn narrower and more three-dimensional than on the slide. This allowed the reconstruction of the natural shape of the digitate process which is now distorted on the preparation. Based on this evidence, we suggest that the slide A.10.4.93 of B. *ingeborgae* is the one mentioned as 6438/ETO in the original description. We further suggest that the specimen lacking the abdomen on the pin with the holotype label is indeed the holotype of *Biselachista ingeborgae*.

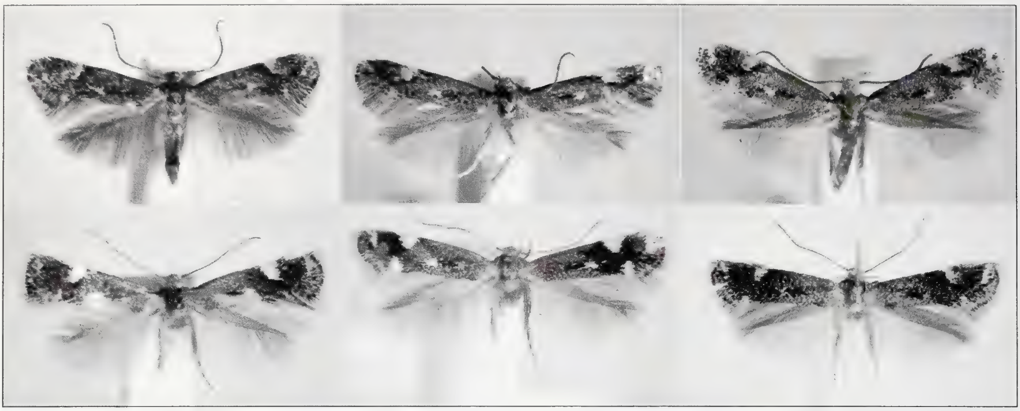


Fig. 10. Habitus of *Elachista occidentalis*. Top row: males, bottom row females. Top left: Austria superior, Umg. v. Linz, 18.vii.1937, Klimesch leg. (ZSM). Top middle: Italy, Piemonte, Parco Natur. Reg. Alpi Maritime 26.vii.1997, Baldizzone leg. (coll. Traugott-Olsen, ZMUC). Top right: Sweden, Sm. Marbäck 19.vii.1966, Svensson leg. (MZLU). Bottom left: Austria, Carinthia Hl. Blut Tauernbg., 1800 m, 18.viii.1974, Klimesch leg. (ZSM). Bottom middle: Finland, Oba: Utajärvi, e. l. 2003 (ex *Carex ericetorum*), Itämies leg. (ZMUO); Bottom right: Poland DV 57, 700 m, Pieniny Mts., Trzy Korony e.l. 2003 (ex *Carex digitata*), Baran leg. et coll.

Elachista occidentalis Frey (Figs. 10–18)

Elachista occidentalis Frey 1882: 372
Biselachista buvati Traugott-Olsen, 1994: 327, **syn. n**
Biselachista ruthae Traugott-Olsen, 1994: 330, **syn. n.**
Biselachista freyi sensu Traugott-Olsen & Nielsen 1977, nec Staudinger, 1870

Material. Lectotype ♂ of *Elachista occidentalis*: LECTO- / TYPE [rounded with blue margin]; *E. occidentalis.* / Frey / Crassier (Loriol).; Frey coll. / Brit. Mus. /1890-62; B. M. ♂ / Genitalia slide / No. 19383; LectoTYPUS ♂ / *Elachista* / *occidentalis* Frey / TESTE U. PARENTI 1976. There is also another specimen, labelled as a paralectotype of *Elachista herrichii* Frey, B. M. slide 19377, *Elachista occidentalis* Frey L. Kaila det. 2000. (Frey coll., no further data, BMNH). Holotype of *Biselachista buvati*, labelled: Holotype; Genital praeparat nr. 5879 sex: ♂; E. Traugott-Olsen; Wing praeparat nr. 6426 sex: ♂ E. Traugott-Olsen; Italia - Piemonte Val Curone (Prov. AL) Poggio di Casasco 9.vi.1983 G. Baldizzone legit; *Biselachista buvati* sp. n. det. E. Traugott-Olsen; coll. E. Traugott-Olsen; coll. ZMUC Copenhagen Denmark. Holotype of *Biselachista ruthae*, labelled: Type; Teriolis mer.; Kreuzb. P. Sexten 1600 m 21.7.1986 J. Klimesch; Genital praeparat nr. B.5.4.93 sex: ♂; E. Traugott-Olsen; Wing praeparat nr. A.6.4.93 sex: ♂ E. Traugott-Olsen; coll. E. Traugott-Olsen; coll. ZMUC Copenhagen Denmark; Holotype *Biselachista ruthae* Traugott-Olsen. Paratypes of *Biselachista ruthae*: 2♂ 2♀, with the same collection data as in the holotype (2♂ 1♀ in ZMUC, ♀ with slides E. Traugott-Olsen B.10.4.93 (genitalia), A.15.4.93 (wings)), 1♂ LK slide 3745, ZSM). **Austria:** 1♂ Austria superior, Klaus, 4.vii.1937, Klimesch leg. (MZLU). 1♂ Umgeb. v. Linz 18.vii.1937, Klimesch leg. (ZSM). 2♂ Carinthia, Rossbach Hl. Blut, 1700 m, 10.viii.1968, 13.viii.1974, Klimesch leg. (TLMF). 4♂ Carinthia, Hl. Blut Tauernbg. 1800 m, 13.–14.viii.1974, Klimesch leg. (slides 3740, IS 6469) (ZSM, MZLU). 2♂ Carinthia, Hl. Blut Tauernbg. A 1700 m, 13.viii.1974, Klimesch leg., with identification label "*Biselachista juliensis* Frey det. E. Traugott-Olsen" (ETO slide 6435, ZMUC, LK slide 3738, ZSM). 1♀ Carinthia, Hl. Blut Tauernbg., 1800 m, 13.viii.1974, Klimesch leg. (ZSM). 1♂ Liesing, 1.viii.1919, '*freyi*' det. E. Jäckh. (ZMUC). 1♂ Osttirol, Virgental, Venedigergruppe, Timmeltal, 2100–2300 m, 1.viii.1993, Ryrholm leg. (TLMF). 3♂, 1♀ Osttirol, Virgental, Venedigergruppe, Sajatmähder E, 2300–2500 m, 12.viii.1993, Ryrholm leg. with identification label "*Biselachista juliensis* Frey det. U. Parenti" (slides U. Parenti 12231, 12519, 12520, 12522, TLMF). 4♂ N. Tirol, Glocknergruppe, Loweraze, 1660–1860 m, 30.–31.vii.1991, Karsholt, Rakosy & Tarmann leg. (slides LK 684, 688, 3192) (ZMUC). 2♂ N. Tirol, Glocknergruppe, above Kals, 1700–2200 m, 29.vii.1991, Karsholt & Rakosy leg. (slide LK 683) (ZMUC). 2♂, 1♀ N. Tirol, Glocknergruppe, Burg bei Kals, 1500 m, 28.–29.vii.1991, Karsholt & Rakosy leg. (ZMUC). 1♂, 1♀ Schnönau a.d. Enns O.Ö. 12.vii.1994, Wimmer leg. (TLMF). 1♂, 1♀ Windischgarsten, O.Ö., Veichltal, 4.vii.1994, Wimmer leg. (TLMF). 1♂ Wien, Haschberg, 10.vi.1917,

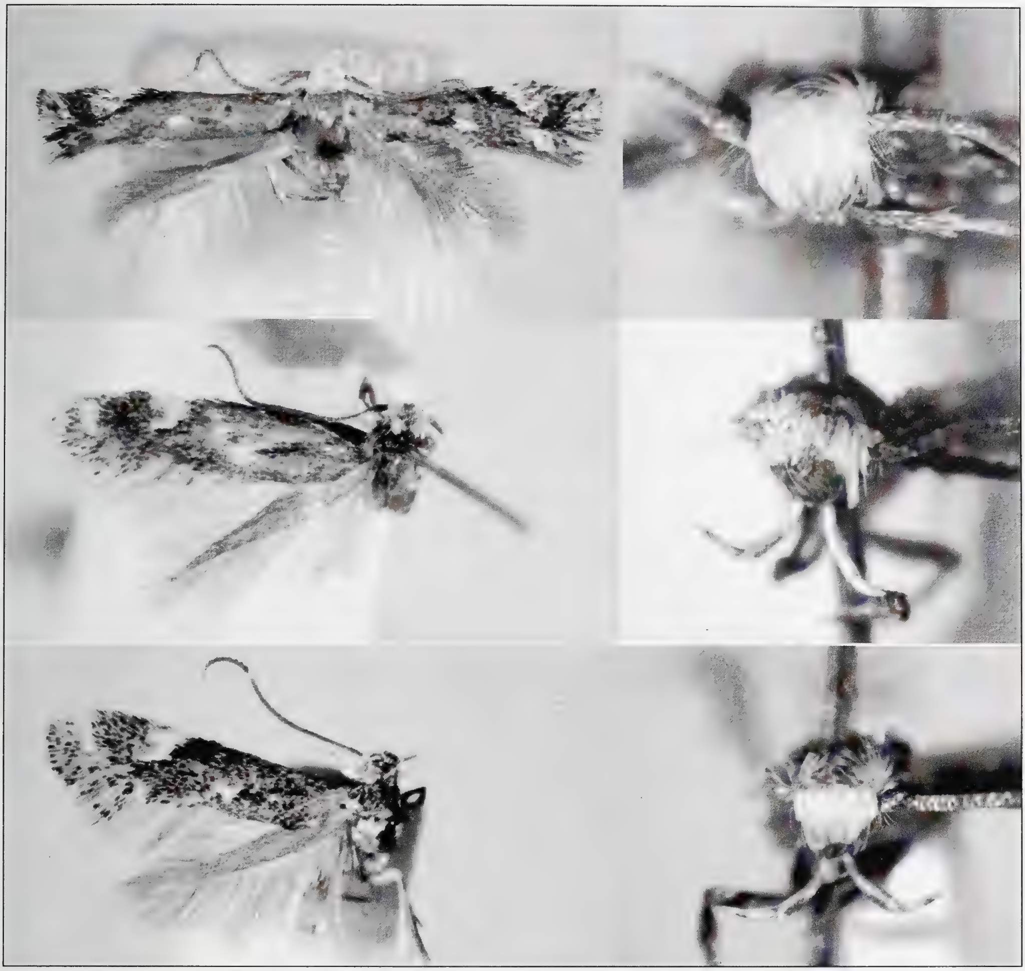
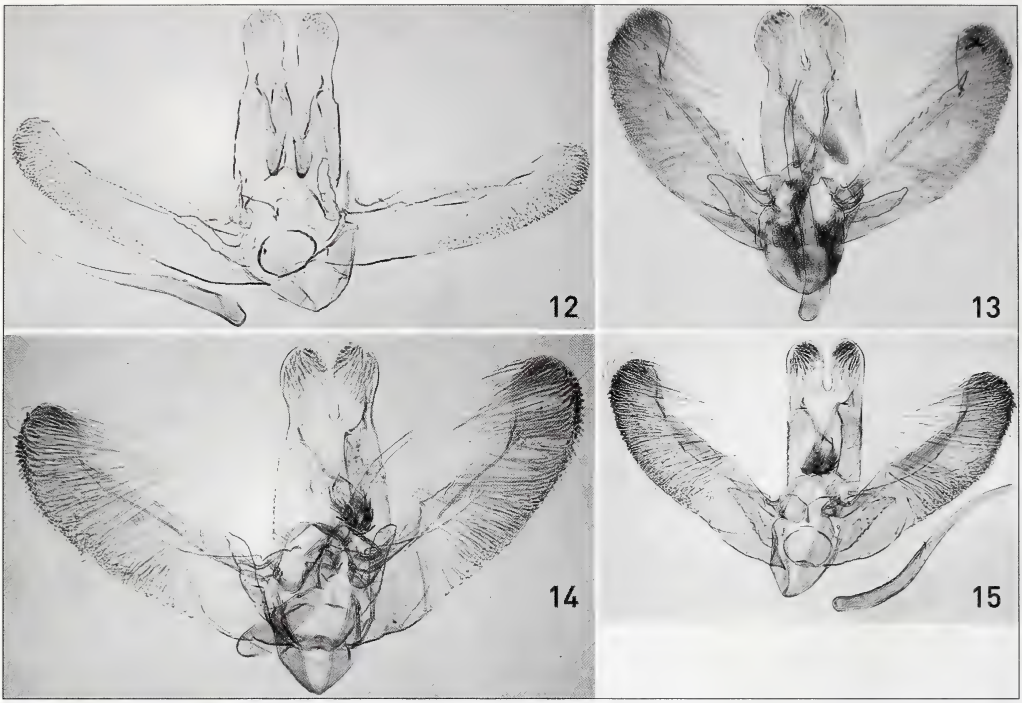


Fig. 11. Habitus and head of the primary types of *Elachista occidentalis* and taxa here considered its junior synonyms. Top: lectotype of *E. occidentalis*, middle: holotype of *Biselachista ruthae*, bottom: holotype of *Biselachista buvati*.

Preissecker leg., '*serricornis*' det. E. Jäckh (ZMUC). **Bulgaria:** 1♂ Asenograd, 20.vi.2000, Junnilainen leg. et coll. (LK slide 3194). 1♀ Pirin, Popovi Livadi, 1300 m, 21.–24.vi.2001, Junnilainen leg. et coll. **Croatia:** 3♂ Plitvice, 17.–20.vii.1984, Schnack leg. (LK slides 3197, 3553, ZMUC). **Estonia:** 2♂ Pidula, 4.vii.1994, Junnilainen leg. et coll. 1♀ Kogula, 20.vi.1994, Junnilainen leg. et coll. **Finland**: *Ab.* 21♂, 9♀ Lohja, 1.viii.1961, 22.vii.1965, 20., 25.vii., 17.viii.1966, 26.vii.1967, 30.vii.1968, 26.vii., 1.viii.1969, 18., 23.vii., 15.viii.1970, 26., 27., 28.vii.1971, 18.vii.1972, 17.vii.1973, 20.vii.1975, 29.vii.1983, 25.vii., 8.viii.1987, 28.vii.1991, Krogerus leg. (slides LK 3731, 3732) (MZH); 1♂ same data, but 1990 (e.l.), Junnilainen leg. (MZH). 1♂ Lohja, Torhola 1993 (e. l. ex *Carex digitata*), Kaila leg. (MZH). *N.* 14♂ 10♀ Siuntio, Andby 668:35, 1991 (e. l. ex *Carex digitata*), Kaila leg. (slides LK 530, 681, 682, 685, 686, 3198, 3199, 3733, 3760–3763) (MZH), 2♂ same data, but 1991, Kaitila leg. (MZH). *St.* 1♂ Säkylä, 27.vii.2003, Kaitila leg. (slide LK 3756) (coll. J.-P.Kaitila). *Ta.* 1♂ Hattula, 28.vi.1936, Lindberg leg. (MZH). 9♂ same data, but Hattula 8.–10.vii.1936, Karvonen leg. (slide LK 687) (MZH). *Sa.* 1♂ Imatra, 12.vii.1955, Nybom leg. (MZH). *Ok.* 1♂ Kuhmo, 9.vii.1980, Nybom leg. (MZH). *Ob.* 2♂ 2♀ Utajärvi 716:47, 24.vii.1976, Kyrki leg. (slides J. Kyrki 1066, 1067) (ZMUO); 3♂ 2♀ (e l.), same data, but larvae 7.v.2003 (in *Carex ericetorum*), Itämies & Leinonen leg. (ZMUO). **France:** 1♂ Hautes Alpes RN 05, Les Vigneaux, 1000 m, 5.vii.2002, Junnilainen leg. et coll. (LK slide 3757); 3♂ 5 km W les Vigneaux, 1250 m, 5.–6.vi.2003, Junnilainen leg. et coll. (LK slide 3759). 1♂ Provence, 2 km N. la



Figs. 12–15. ♂ genitalia of *Elachista occidentalis*. **12.** *E. occidentalis*, lectotype (BM 19383, BMNH). **13.** Holotype of *Biselachista ruthae* (ETO A.3.4.93, ZMUC). **14.** Holotype of *Biselachista buvati* (ETO 5879, ZMUC). **15.** *E. occidentalis* from Finland (LK 3772).

Mur, 17.v.2003, Hendriksen leg. (ZMUC). **Germany:** 4♂ Baden, Grenzacherhorn, Paravicini coll. B. M. 1937–383 (BMNH). 1♂ (abdomen missing) '*E. serricornis* (Sta vid.) Sta Baden Baden, Frey coll., Brit Mus. 1890-62 (BMNH). 1♂, 1♀ [no locality given] Frey coll., Brit. Mus. 1890-62 (BMNH). 1♂ Regensburg, 15.vi.1932 (e. l. ex *Carex silv.*), Sälzl. leg., (LK slide 3743, ZSM). **Greece:** 1♂ Peloponés, Taygetos, vi.1996, Lastuvka leg. (LK slide 3552) (ZMUC). 2♂ Pindos, Konitsa, Pades, 6.vii.1981, Grotenfelt leg. et coll. (LK slides 3549, 3551). **Italy:** 4♂, 1♀ Friuli, Fiume Felia nr. Carnia, 240 m, 26.vi–2.vii.2003, Skule & Hviid leg. (ZMUC). 8♂ Piemonte (CN) Parco Natur. Reg. Alpi Maritime, S. Giacomo di Entracqua sopra Lago della Rovina, 1800–2000 m, 20., 26.vii.1997, and 1♂ same data, but 1550–1850 m, 20.vii.1997, all Baldizzone leg., and with identification label "*Biselachista ingeborgae* Tr.-O. det. E. Traugott-Olsen (coll. Baldizzone, ZMUC, LK slide 3862). 1♂ Piemonte (CN) Parco Natur. Reg. Alpi Maritime, Trinità (Entracque), Vallone Grande, 1400 m, 16.vii.1996, Baldizzone leg., with identification label "*Biselachista ingeborgae* Tr.-O. det. E. Traugott-Olsen (coll. Baldizzone). 1♂ Prov. Trento, Lago di Molveno, 10.vii.1983, De Prins leg. (LK slide 3741) (ZSM). 2♂ Südtirol, Montiggl Kl. Priol, 600 m, 26.vi.1993, 14.vii.1993, Huemer leg. (TLMF). 1♂ Südtirol, 400 m, Pfatten, Mitterberg, NO-Hang, 12.vii.1991, Huemer leg., with identification label "*Biselachista juliensis* Frey det. U. Parenti" (slide U. Parenti 12516) (TLMF). 1♂, 1♀ Teriolis mer., Kreuzberg Pass, 1600 m, 22.vii.1988, Klimesch leg. (♂ in ZSM, ♀ in MZH). 2♂ Kreuzberg, P. Sexten, 1660 m, 21.vii.1986, Klimesch leg., one specimen with identification label "*Biselachista juliensis* Frey det. E. Traugott-Olsen" (slide ETO 6437, ZMUC). **Poland**: Glinki n. Torún e. l. 23.v.1997 1♂, 14.v.1999 1♂, 31.v.2003 1♀ ex *Carex ericetorum*, all T. Baran leg. (LK slides 3746, 3860, 3864, MZH). 1♂, 1♀ Pieniny Mts. Trzy Korony, 700 m, 12., 15.vi.2003 (e. l., ex *Carex digitata*), Baran leg. (LK slides 3861, 3863, MZH). **Sweden:** *Gtl.* Fleringe 14.vii.1969 1♂ I. Svensson leg. (MZLU). 1♀ Frijel, 16.vii.1977, Svensson leg. (slide IS 5873) (MZLU). 1♀ Lojsta, 18.vii.1965, Svensson leg. (slide IS 4641) (MZLU). 1♀ Rute, 7.vii.1984, Svensson leg. (slide IS 6804) (MZLU). 1♂ Tingstide, 4.vii.1969, Svensson leg. (slide IS 4788) (MZLU). 1♂ Vamlingbo, 16.vii.1959, Ekström leg.; 1♂ same data, but 14.vii.1977, Svensson leg. (MZLU). 1♀ Öja, 21.vii.1933, Benander leg. (MZH). *Sm.* 1♂ Högsby 13.–14.vii.1968, Svensson leg. (MZLU). 6♂, 1♀ Marbäck, 19.vii.1966, Svensson leg. (slide IS 4651) (MZLU). *Vg.* 2♂ Kinnekulle, 1.–2.vii.1966, 16.vi.1968, Svensson leg. (slide 4128) (MZLU). 2♂ Österplana 19.vii.1962, Svensson leg. (MZLU). *Öl.* 7♂ Gårdby, 4.vii.1989, 13.vii.1985, Svensson leg. (MZLU). 1♂ Hulterstad, 25.vi.1973, Svensson leg. (MZLU). 3♂

Karums alvar, 23.vi.1959, Svensson leg. (slide IS 3100) (MZLU). 1♂ Kårehamn 23.vi.1973, Svensson leg. (MZLU). 1♂ Vickleby 13.–15.vii.1961, Svensson leg. (MZLU). *Ög.* 1♂ Kolmården, 23.vii.1975, Svensson leg. (slide IS 5644) (MZLU). **Switzerland:** 1♂ Baselland, Hardwald, Paravicini coll. B. M. 1937-383 (BMNH). – uncertain locality: 1♂, 2♀ [no locality given] Stainton coll. Brit. Mus. 1893-134 (BMNH).

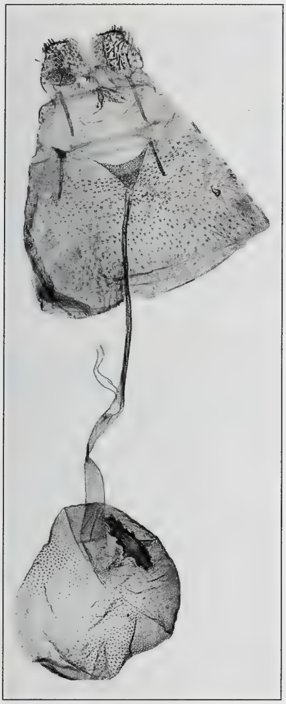


Fig. 16. ♀ genitalia of *E. occidentalis* from Finland, Siuntio (LK 3199).

Description. Forewing length ♂ 3.2–4.5 mm, ♀ 3.1–4.3 mm. Male: Labial palpus ascending, length 1.4–1.5 times diameter of head; above white except base of 3rd segment narrowly grey, below variably powdered with grey in middle of 2nd and 3rd segments. Head shiny white, variably mottled with grey-tipped scales above and sometimes laterally. Neck tuft usually mottled grey, sometimes almost entirely white. Thorax grey, scales of tegula and metascutum whitish, grey-tipped. Forewing ground colour varying from grey to dark grey or brownish, with five white markings which vary in size and brightness: 1 – indistinct small white streak basally, 2 – another more distinct streak distally from black streak situated at fold before middle of wing, 3 – triangular costal spot at distal 2/3 of costa, 4 – small more or less rounded tornal spot beyond costal spot, and 5 – transverse streak at apex; costal spot basally delimited with oblique straight black streak. Fringe scales grey, basal fringe scales black-tipped forming black fringe line. Hindwing grey. Underside of fore-wing dark grey, fringe at costal and tornal spots creamy white; underside of hindwing grey. Female as male but forewing ground colour dark grey with brighter and more expanded white pattern.

Male genitalia. Uncus lobes about 1.3 times longer than broad, distally rounded; median incision between them narrow, u-shaped. Mesal margin of juxta lobes short, straight; distal margin somewhat rounded, medially with a group of long scales; digitate process rather narrow, distally variable, oblique and acute-tipped; length 0.28–0.3 times length of valva; valva somewhat bent, width strongly variable, 0.25–0.30 times length at widest point; basal and distal fold of costa meeting at 1/3 length of valva; distal fold wrinkled; length of cucullus 1/4 length of valva, longer than wide, somewhat bent towards costa, distinctly twisted over distal fold of costa. Aedeagus gradually tapered towards apex, 0.80–0.95 times length of valva, slightly bent s-shaped, caecum as long as basal opening of aedeagus; vesica with very indistinct straight and narrow cornutus about 0.15–0.22 times length of aedeagus.

Female genitalia. Papillae anales rounded, covered with long and thin setae, distally also with short and stout setae. Apophyses posteriores stout, rather straight, length variable to some extent. Apophyses anteriores varying from 2/3 to full length of apophyses posteriores, stout or slender. Ostium bursae occupying over half width between apophyses anteriores, dorsal wall spinose; antrum as broad as deep, internally spinose; ductus bursae posteriorly narrow, tubular, broader cephalad from inception point of

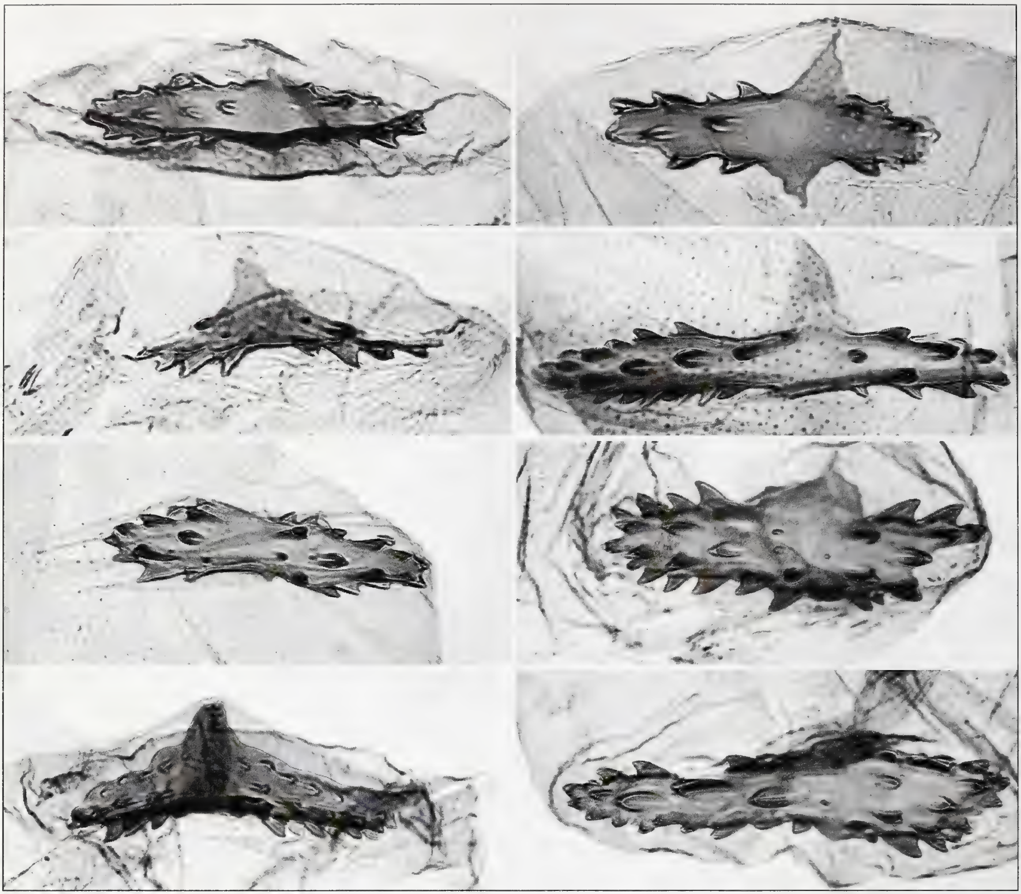


Fig. 17. Signum in *Elachista juliensis* and *E. occidentalis,* showing variation found within single populations. Left column: *E. juliensis*, all from ex ovo series: Italy, Piemonte, Chiusa San Michele (TO), Sacra S. Mich., 850 m, A.168 1994, P. G. Varalda leg., slides from top to bottom LK 3881, LK 3882, LK 3883, LK 3884. Right column: *E. occidentalis*, all from Finland Siuntio, Andby, larva ex *Carex digitata* 1991, Kaila leg., slides from top to bottom LK 3199, LK 3760, LK3761, LK3762.

ductus seminalis; sclerotisation of colliculum long, almost extended from antrum to inception of ductus seminalis; ductus bursae distinct from corpus bursae; corpus bursae largely covered with distinctive internal spines; signum an elongate dentate plate of variable shape.

Life history. *E. occidentalis* occurs in montane areas in Central and southern Europe. In northern Europe it inhabits xerothermic sites. The adults sometimes have been caught in the evening, and in Central and southern Europe they are attracted to light. The species is univoltine. The larva feeds on *Carex digitata* and *C. ericetorum.* The full-grown larva is 5–7 mm long, greyish green, with the prothoracic and anal plates amber-coloured. The mine is 10–15 cm long, situated either along the mid-rib or the margin of the leaf. The initial mine, constituting about half the total length of the mine, is very thin and then gradually widens. Towards the end it occupies about half the width of the leaf. Pupation takes place in laboratory conditions usually on the mid-rib

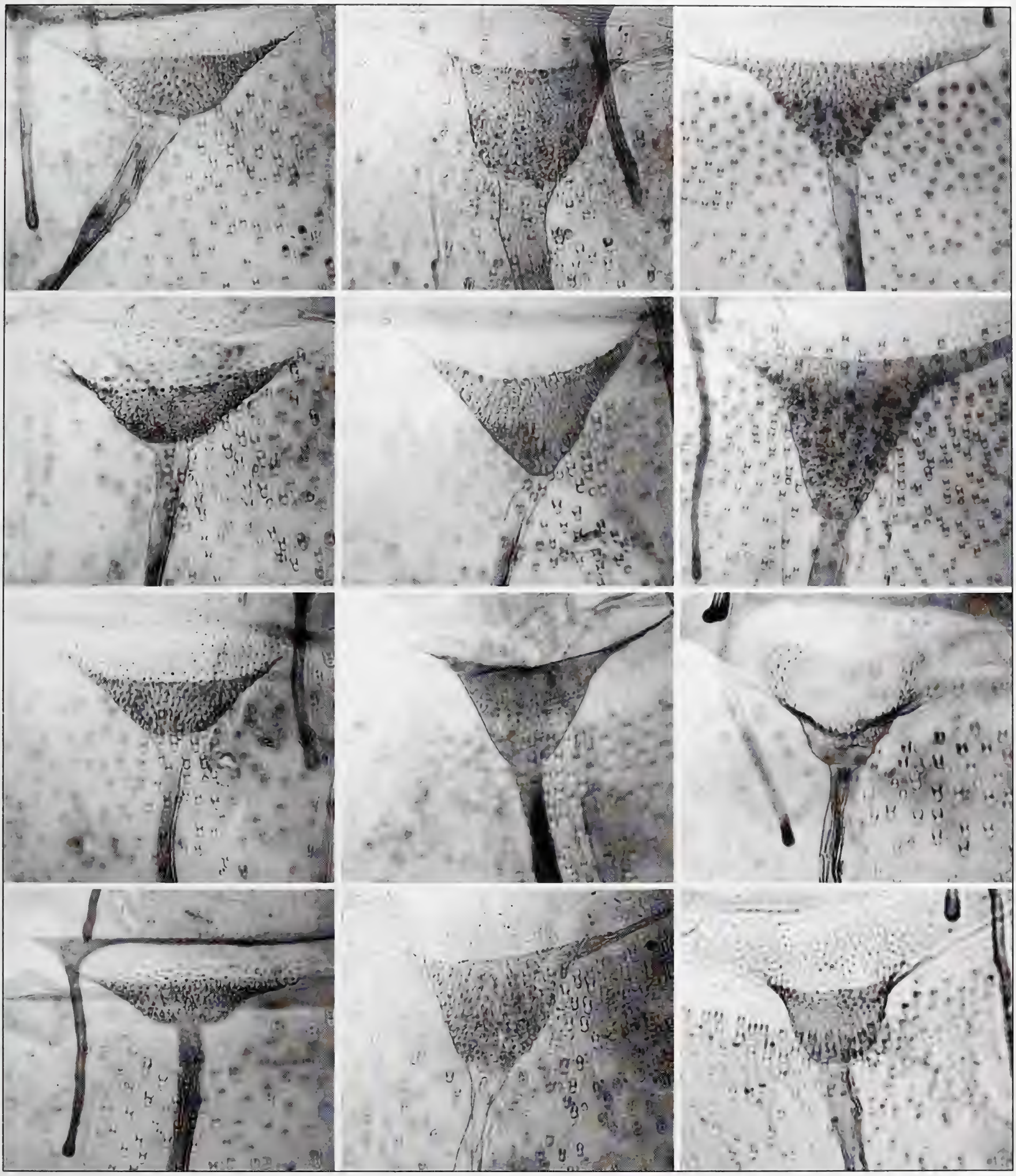


Fig. 18. Variation in the shape of the antrum in *Elachista juliensis*, *E. occidentalis*, *E. ribentella* and *E. zonulae*. Left column *E. juliensis*, from top: Austria inf. Dürnstein (slide LK 3772), Italy, Dintorni Trento (slide LK 3768), Italy, Piemonte Chiusa San Michele (TO), Sacra S. Mich., 850 m (slide LK 3890), Italy, Piemonte (slide LK 3890). Middle column *E. occidentalis*, from top: Italy Kreuzberg P. Sexten (paratype of *E. ruthae*) slide (ETO B.10.4.93), Finland N: Siuntio (slide LK 3199), ditto (slide LK3760) Sweden, Småland, Marbäck (slide I. Svensson 4651). Right column from top: *E. ribentella* sp. n. paratype, Japan, Hokkaido, Kyôwa-Town (slide Sugisima 0760), ditto (slide Sugisima 0983), *E. zonulae*, Poland, Tatra Mts., Giewont (slide LK 3201), ditto, Russia, Altai, Chuja Valley (slide LK 3907).

of the leaf, sometimes elsewhere, often in a corner of the rearing pot. The pupa is brown, attached to the substrate with a silken girdle.

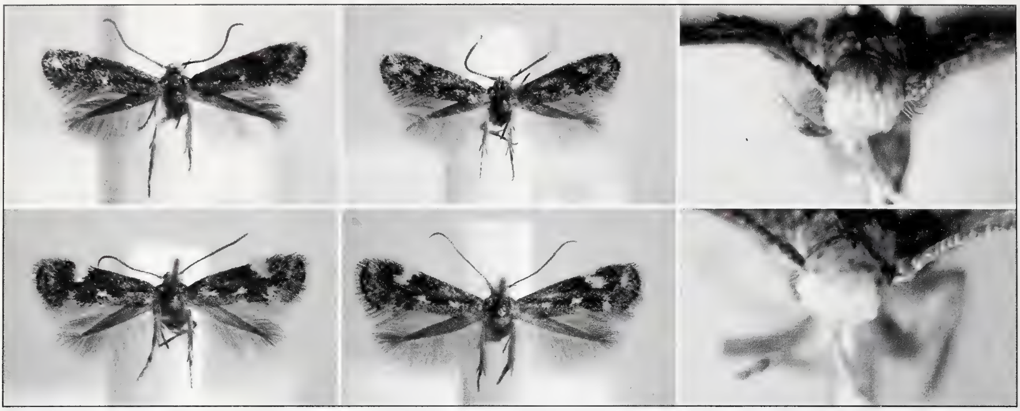


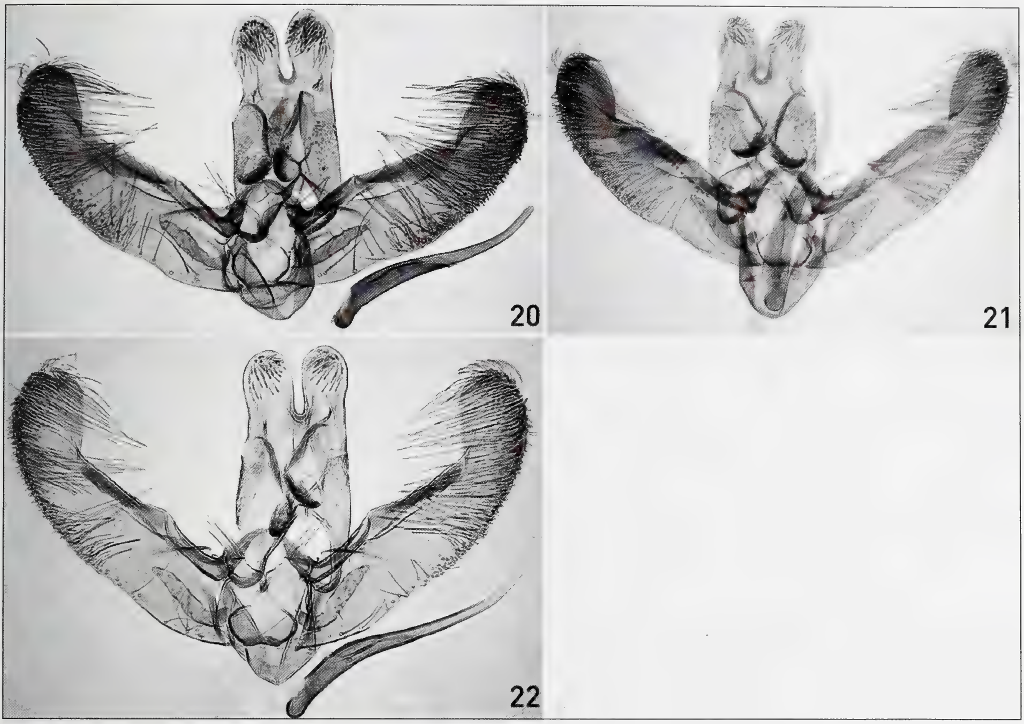
Fig. 19. Habitus of *Elachista ribentella* sp. n. Top row males: holotype (Japan: Hokkaido: Sinsennuma, Kyôwa-Town) paratype ditto, head of the holotype. Bottom row females: 2 paratype ditto.

Distribution. Widespread in Europe, material studied from Austria, Bulgaria, Croatia, Estonia, Finland, France, Germany, Greece, Italy, Poland, Sweden, and Switzerland.

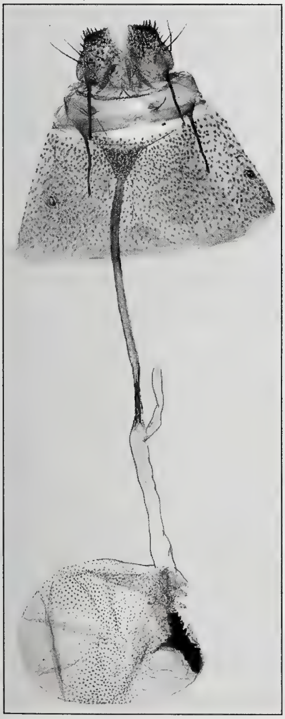
Remarks. *E. occidentalis*, as here delimited, is a somewhat variable species, both in colouration and in male genitalia. No obvious trends in any character combination have been detected, and the range of variation in genitalia seems present in populations throughout the distribution range. In central and southern Europe, and in some dry sites also in northern Europe, specimens tend to be paler than those from more northern or humid areas, but variation is great and overlapping everywhere. The holotypes of *Biselachista buvati* Traugott-Olsen, 1994 and *Biselachista ruthae* Traugott-Olsen, 1994 are within the variation observed in *Elachista occidentalis*, and these names are here considered junior synonyms of *Elachista occidentalis*. Note, however, that the male genital illustrations of *Biselachista buvati* in its original description were drawn from a paratype, not the holotype (Figs. 25 and 33 in Traugott-Olsen 1994). They obviously depict *Elachista zonulae* Sruoga (the specimen was not studied). The specimen labelled as the holotype of *B. buvati* (habitus and wing venation illustration in the original description by Traugott-Olsen 1994: figs. 4, 16) is not conspecific with this paratype, and its characteristics, including those of the male genitalia (Fig. 14), fall well within the variation observed in *Elachista occidentalis*. The ♀ habitus acquarel showing *E. occidentalis* in Traugott-Olsen (1994) was painted from an *E. juliensis* specimen (in coll. ZMUC). The valva and the uncus lobes of the holotype of *E. ruthae* appear broader than in other specimens here assigned to *E. occidentalis*. This is due to distortion caused by superfluous squeezing of the genitalia on this slide. Other specimens from the same series from which the holotype of *E. ruthae* was selected, are just like any other representative of *E. occidentalis*.

Elachista ribentella sp. n. (Figs. 18–23)

Material. Holotype ♂, labelled: **Japan**: Hokkaido: Sinsen-Marsh, Kyôwa-Town, em. 13.vii.1995 K. Sugisima leg., Host 00118 *Carex blepharicarpa*, ♂ genitalia slide no. 0982 K. Sugisima, 2002. (SEHU).



Figs. 20–22. ♂ genitalia of *Elachista ribentella* sp. n. **20.** Holotype (Sugisima 0982). **21.** Paratype from Japan (Sugisima 0734). **22.** Paratype from Russia (LK 3749).



Paratypes (11♂, 2♀): 7♂, 2♀ same data, but, e. l. ex *Carex blepharicarpa*, 14.vii.1995, 1., 17., 19.vii.1996, 21.vi.1998, Sugisima leg. (SEHU, 2♂ in MZH); 2♂ Honsyû, Ueno, Azusagawa, Nagano Pref. 13.vii.1982, 22.vii.1982, Hirano leg. (SEHU). **Russia**: 1♂ S. Primorje, 43°16′N 134°04′E, Lazowski Res., 5.–9.viii.1998; 1♂ S. Primorje 43°38′N 132°33′E Ussuriskij Res., 250 m, 29.–31.vii.1998, Jalava, Kullberg & Kaare leg. (MZH). – Additional material: **Russia**: 2♂, S. Primorje, 20 km E Ussurijska, 7.viii.1982, 10.viii.1982, Puplesis leg. (MZH) [specimens in bad condition, glued on cardboard].

Description. Forewing length ♂ 2.7–3.5 mm, ♀ 3.5–3.7 mm. Male: Labial palpus ascending, length 1.2–1.3 times diameter of head; above greyish or ochreous white except base of 3rd segment narrowly grey, below powdered with grey in the middle of 2nd and 3rd segment. Head shiny ochreous or greyish white, variably mottled with grey-tipped scales laterally and on vertex. Scape and pedicel of antenna above mottled grey, flagellum thick greyish white below on basal 2/3, above grey, annulated with somewhat paler rings.

Fig. 23. ♀ genitalia of *Elachista ribentella* sp. n. paratype (Japan) (Sugisima 0983).

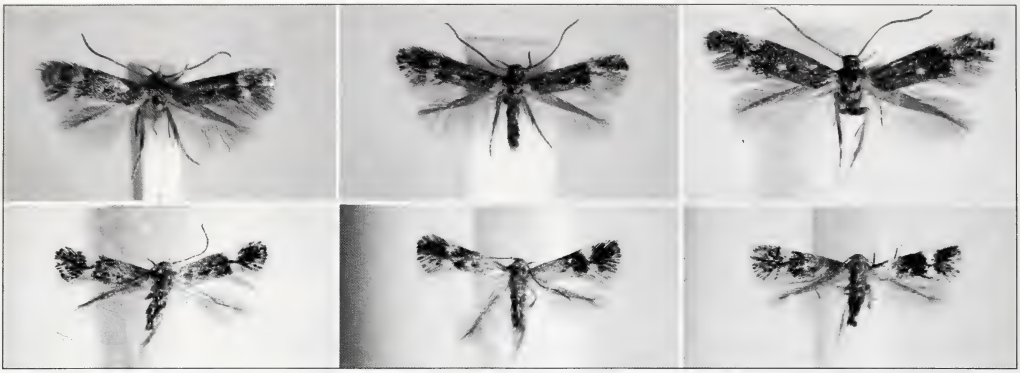


Fig. 24. Habitus of *Elachista zonulae*. Top row: males, bottom row females. Top left: Austria, Teriolis Sept., Nordkette, 1500 m, 29.vii.1943, Burmann leg. (TLMF). Top middle: Poland, Tatra Mts. 1350 m, Sarnia Skals 7.vii.1987, Buszko leg. (ZMUC). Top right: Poland, Tatra Mts. Kominiarski Wierch, 1700–1800 m 28.vii.1997, Nupponen & Junnilainen leg. (coll. T. & K. Nupponen). Bottom left and middle: Russia, Altai Mts., Chuja Valley, 1500 m, 5 km SE Aktash 14.vii.2001, Nupponen leg. (coll. T. & K. Nupponen). Bottom right: Russia, Altai Mts., Kuraisky Hrebet, 2300 m, 9.vii.201, Nupponen leg. (coll. T. & K. Nupponen).

Neck tuft mottled grey. Thorax mottled grey, scales of tegula and metascutum whitish, grey-tipped. Forewing ground colour mottled grey, with four indistinct mottled whitish markings: 1– small streak distally from black streak situated in fold before middle of wing, 2 – triangular costal spot at distal 2/3 of costa, 3 – small, more or less rounded tornal spot beyond costal spot, and 4 – transverse streak at apex; costal spot basally delimited with obliquely oriented, straight black streak and another pronounced streak at fold at 3/4 wing length. Fringe scales grey, basal fringe scales black-tipped forming black fringe line. Hindwing grey. Underside of forewing dark grey, fringe at costal and tornal spots creamy white; underside of hindwing grey. Female as male but forewing ground colour darker grey with brighter and more expanded white pattern, also with small white streak basally delimiting black streak of fold.

Male genitalia. Uncus lobes about 1.5 times longer than broad, distally rounded; median incision between them narrow, u-shaped. Mesal margin of juxta lobes short, straight; distal margin somewhat rounded, medially with a group of long scales; digitate process narrow, distally variable, oblique and acute-tipped; length 0.28–0.30 times length of valva; valva somewhat bent, width strongly variable, 0.28–0.31 times length at widest point; basal and distal fold of costa meeting at 1/3 length of valva; distal fold even or somewhat wrinkled, distinctly sclerotised and often remarkably widened distally; length of cucullus 1/4 length of valva, longer than wide, somewhat bent towards costa, distinctly twisted over distal fold of costa. Aedeagus gradually tapered towards apex, length 0.75–0.78 times length of valva, slightly bent s-shaped, caecum as long as basal opening of aedeagus; vesica with straight narrow cornutus, 0.31 times as long as aedeagus.

Female genitalia. Papillae anales rounded, covered with long and thin setae, distally also with short and stout setae. Apophyses posteriores stout, rather straight, length variable to some extent. Apophyses anteriores almost as long as apophyses

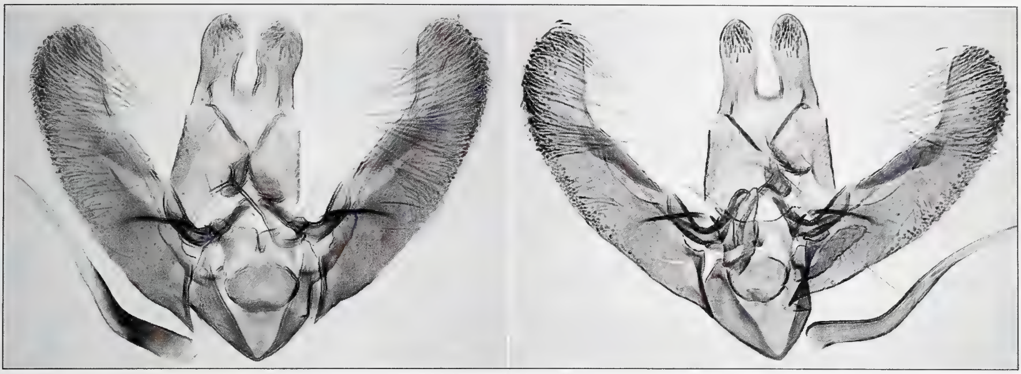


Fig. 25–26. ♂ genitalia of *Elachista zonulae*. **25.** *E. zonulae* from France (LK 3758). **26.** *E. zonulae* from Russia, Altai (LK 3732).

posteriores, slender. Ostium bursae occupying over half width between apophyses anteriores, dorsal wall spinose; antrum of variable shape, internally strongly spinose; ductus bursae posteriorly narrow, tubular, broader cephalad from inception point of ductus seminalis; sclerotisation of colliculum long, almost extended from antrum to inception of ductus seminalis; ductus bursae distinct from corpus bursae; corpus bursae largely covered with distinctive internal spines; signum an elongate dentate plate of variable shape.

Life history. *E. ribentella* has been reared from *Carex blepharicarpa*. The type locality is the wet edge of a peat bog. Specimens from Ueno, Japan have been collected in a moderately humid conifer forest (K. Sugisima, pers. comm.). The specimens from the Russian Far East collected by Jalava, Kullberg, and Kaare were found in a lush meadow and in a ruderal village habitat (J Kullberg., pers. comm.).

Distribution. Japan, Russia (Far East).

Remarks. The specimens reported as *Biselachista freyi* from the Russian Far East by Sruoga (1995) are referable to *E. ribentella*.

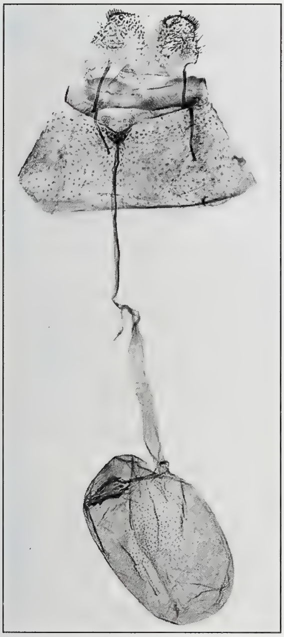


Fig. 27. ♀ genitalia of *Elachista zonulae* (Sruoga) (Poland, Tatra Mts., Giewont, LK 3201).

Elachista zonulae (Sruoga, 1992) (Figs. 18, 24–27)

Biselachista zonulae Sruoga *in* Sruoga & Puplesis 1992: 440

Material. **Austria:** 1♂ Teriol. sept. Nordkette, 1400 m, 22.viii.1939, Burmann leg. (LK slide 3858, TLMF); 1♂ same data, but 1500 m, 29.vii.1943, Burmann leg. (LK slide 3857, TLMF), both with identification label "*Elachista juliensis* Frey det. U. Parenti". **France:** 1♂ Hautes Alpes RN05 5 km W Les Vigneaux, 1250 m, 5.–6.vi.2003, Junnilainen leg. et coll. (LK slide 3758). **Kyrgyzstan:** 2♂ 10 km SE Lake Song Köl, steppe/river bed, 41°30′N 75°35′E, 26.vii.1990, Kaila leg. 3♂, 1♀ 45 km NE Naryn, 2650 m, dry meadow, 41°40′N 76°31′E, 31.vii.1990, Kaila leg. 10♂ 41 km E Naryn, 2850–3300 m, steppe-alpine meadow, 41°20′N 76°26′E, 31.vii.–7.viii.1990, Kaila leg. (all in MZH). **Poland**: 19♂, 1♀ Tatra Mts., Bobrowiec, 1400–1500 m, Mnichy Chocholowskie, 23.vii.1997, Nupponen & Junnilainen leg. (LK slide 3193, coll. Junnilainen, coll. Nupponen, 1♂ in MZH). 3♂ Tatra Mts., Kominiarski Wierch, 1700–1800 m, 28.vii.1997, Nupponen & Junnilainen leg. et coll. (LK slide 3755). 1♀ Tatra Mts., Giewont, Mnich Malolacki, 24.vii.1997, Nupponen & Junnilainen leg. (LK slide 3201, coll. Junnilainen). 1♂ Tatra Mts., Sarnia Skała, 1350 m, 7.vii.1987, Buszko leg. (ZMUC). **Russia**: 4♂, 1♀ Altai Mts., 50°16–20′N 87°50–55′E, Kuraisky hrebet, 2300 m, 9.vii.2001, Nupponen leg. 2♂, 2♀ Altai Mts., Chuja valley, 5 km SE Aktash village, 1500 m, 50°14–16′N 87°40′E, 14.vii.2001, Nupponen leg. (coll. Nupponen, 1♀ in MZH).

Description. Forewing length ♂ 2.5–3.5 mm, ♀ 2.4–2.8 mm. Male: Labial palpus ascending, length 1.1–1.2 times diameter of head; above whitish grey except base of 2nd and 3rd segments variably grey, below grey. Head, neck tuft, and thorax mottled grey. Forewing ground colour dark grey, with three greyish white markings: 1 – streak distally from black streak situated at fold before middle of wing, 2 – triangular or rounded costal spot at distal 2/3 costa, 3 – another similar tornal spot opposite costal spot. Fringe scales grey, basal fringe scales darker grey-tipped forming indistinct fringe line. Hindwing grey. Underside of forewing dark grey, fringe at costal and tornal spots creamy white; underside of hindwing grey. Female as male but forewing ground colour darker with brighter and more expanded white pattern.

Male genitalia. Uncus lobes about twice longer than broad, distally rounded and slightly broadened; median incision between them almost as broad as basal width of uncus lobes, u-shaped. Mesal margin of juxta lobes short, straight, distal margin somewhat concave, laterally with group of long scales; digitate process blunt-tipped, length 0.22–0.28 times length of valva; valva somewhat bent, width variable, 0.27–0.30 times length at widest point; basal and distal fold of costa meeting at 1/4 length of valva; distal fold even; cucullus 1/4 length of valva, longer than wide, somewhat bent towards costa, weakly twisted over distal fold of costa. Aedeagus gradually tapered towards apex, 0.80–0.95 times as long as valva, strongly bent at basal 1/3, s-shaped, caecum shorter than basal opening of aedeagus; vesica with very indistinct, straight narrow cornutus, about 0.22–25 times length of aedeagus.

Female genitalia. Papillae anales rounded, covered with long and thin setae, distally also with short and stout setae. Apophyses posteriores stout, rather straight, length variable to some extent. Apophyses anteriores varying from 2/3 to full length apophyses posteriores, stout or slender. Ostium bursae occupying about 1/3 width between apophyses anteriores, dorsal wall spinose; antrum about as broad as deep, internally strongly spinose; ductus bursae posteriorly narrow, tubular, broader cephalad from inception point of ductus seminalis; sclerotisation of colliculum long, almost extended from antrum to inception of ductus seminalis; ductus bursae inserted distinct from corpus bursae; corpus bursae largely covered with distinctive internal spines; signum an elongate dentate plate of variable shape.

Life history. In Central Asia and Siberia *E. zonulae* occurs in high altitude xerothermic meadows. In Poland and the Alps the habitat is similar, although the species has been found in somewhat lower altitudes. Baran (2003), based on Buszko & Baraniak (1989), reports the larva to feed on *Carex sempervirens*. The adult is active in the afternoon and evening before sunset. The species is univoltine.

Distribution. Transpalaearctic; material examined from Austria, France, Kyrgyzstan, Poland, and Russia (Altai Mts.). Sruoga (1992) reports it also from Kazakhstan and Tajikistan, and Tokár et al. (1999) from Slovakia. *E. zonulae* is recorded from the Alps, Tatra Mts., Tian Shan Mts. in Kazakhstan, and Tajikistan, and Altai Mts. in Siberia.

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A taxonomic study on the genus *Rhopalovalva* Kuznetzov, 1964 from China (Tortricidae: Olethreutinae)

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Abstract. Seven species of the genus *Rhopalovalva* Kuznetzov from China are treated in this paper. Descriptions of two new species *R. ovata* sp. n. and *R. orbiculata* sp. n. are given, with genital structures illustrated. A key to all known Chinese species is provided.

Key words. Lepidoptera, Tortricidae, Olethreutinae, *Rhopalovalva*, new species, China.

Introduction

Kuznetzov erected the genus *Rhopalovalva* in 1964 for *Eudemis lascivana* Christoph, 1881 and transferred three more species to the genus: *R. exartemana* (Kennel, 1901), *R. cordelia* (Meyrick, 1935), and *R. grapholitana* (Caradja, 1916), but Clarke (1958) synonymized *A. cordelia* with *A. grapholitana*. Later, Diakonoff (1973) and Kuznetzov (1976b) transferred one species each from *Acroclita* Lederer, 1859 and *Phoxopteryx* Sodoffsky, 1837 to *Rhopalovalva*, viz. *R. catharotorna* (Meyrick, 1935) and *R. pulchra* (Butler, 1879). In addition, Oku (1974) described *Rhopalovalva amabilis* from Japan. Thus, up until now, six valid *Rhopalovalva* species were recognized. They occur in Korea, Japan, and Russia, and five of them have been recorded from China (Razowski 1999; Liu & Li 2002). In the present paper, two new species are described from China. The type specimens are deposited in the Department of Biology, Nankai University, Tianjin, China. The research was supported by the National Natural Science Foundation of China for the Special Program.

Rhopalovalva Kuznetzov, 1964

Rhopalovalva Kuznetzov, 1964: 883. Type species: *Eudemis lascivana* Christoph, 1881.

Key to Chinese species of *Rhopalovalva* based on male genitalia characters

1.	Cucullus ventrally with process spinous	2
-	Cucullus ventrally with process not spinous	3
2.	Sacculus angle with slender hairy lobe; valva constricted deeply	*R. catharotorna*
-	Sacculus angle with broad hairy lobe; valva constricted slightly	*R. pulchra*
3.	Socius ovate; cucullus with short clubbed process ventrally	*R. ovata* sp. n.
-	Socius long and narrow; cucullus with slender process ventrally	4
4.	Uncus with slightly broader apex; socius about equal in length to uncus	*R. orbiculata* sp. n.
-	Uncus with pointed apex; socius obviously longer than uncus	5
5.	Cucullus with process apically dilated	*R. grapholitana*
-	Cucullus with process not apically dilated	6
6.	Sacculus angle with slender hairy lobe	*R. exartemana*
-	Sacculus angle with broad and short hairy lobe	*R. lascivana*

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Rhopalovalva catharotorna (Meyrick, 1935: 53) (Acroclita)

Material. 1♂, Jixian (40°02' N, 117°24' E), Tianjin, 550 m, 23.vi.2001, leg. Houhun Li; 1♀, same data, but 510 m, 16.viii.1997.

Remarks. Wingspan 12.0 mm. The species was treated and transferred to *Rhopalovalva* by Diakonoff (1973: 629). It is known to occur in China (Tianjin, Shanghai, Zhejiang, Taiwan) and Japan.

Rhopalovalva exartemana **(Kennel, 1901: 260) (*Acroclita*)**

Remarks. The species was transferred to *Rhopalovalva* by Kuznetzov (1964: 885) and is recorded from China (Northeast part), Korea, Japan, and Russia (Far East).

Rhopalovalva grapholitana **(Caradja, 1916: 60) (*Acroclita*)**

Acroclita cordelia Meyrick, 1935: 52.

Material. 6♂, Wenxian (32°58' N, 104°41' E), Gansu Province, 2000 m, 5.vii.2001, leg. Houhun Li and Xinpu Wang; 1♂, Ziyang County (32°33' N, 108°32' E), Shaanxi Province, 350 m, 21.v.1994, leg. Jin Zhou; 2♂, Gushi County (32°10' N, 115°41' E), Henan Province, 120 m, 16.v.1995, leg. Guangyun Yan.

Remarks. Wingspan 18.0 mm. The species was redescribed and transferred to *Rhopalovalva* by Kuznetzov (1964: 886). It is found in China (Northeast part, Shanghai, Anhui, Jiangxi, Henan, Shaanxi, Gansu), Korea, and Russia (Far East).

Rhopalovalva lascivana **(Christoph, 1881: 405) (*Eudemis*)**

Material. 1♀, Libo County (25°24' N, 107°52' E), Guizhou Province, 23.v.1998, leg. Qirong Liao.

Remarks. Wingspan 10.5 mm. The species was treated and transferred to *Rhopalovalva* by Kuznetzov (1964: 885). It is distributed in China (Guizhou), Korea, Japan, and Russia (Far East).

Rhopalovalva pulchra **(Butler, 1879: 79) (*Phoxopteryx*)**

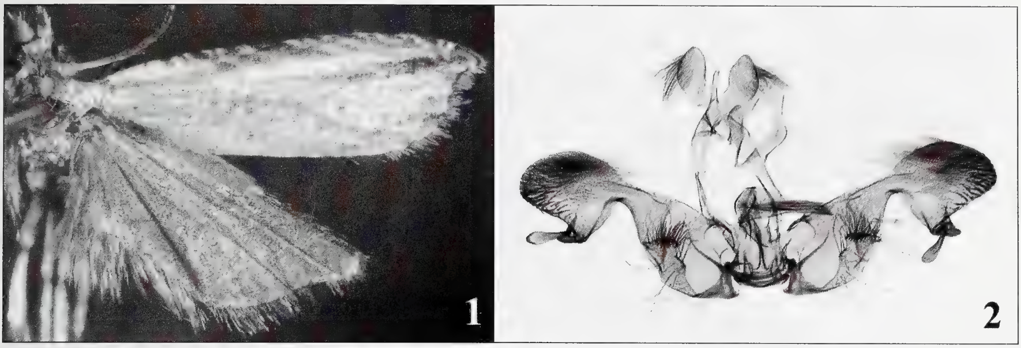
Material. 1♂, Mt. Tianmu (30°26' N, 119°34' E), Zhejiang Province, 350 m, 15.viii.1999, leg. Houhun Li et al.

Remarks. Wingspan 11.5 mm. The species was treated and transferred to *Rhopalovalva* by Kuznetzov (1976: 19). It is known from China (Zhejiang), Korea, Japan, and Russia (Far East).

Rhopalovalva ovata **sp. n.** **(Figs. 1, 2)**

Material. Holotype ♂, Sangzhi County (29°23' N, 110°10' E), Hunan Province, 1250 m, 13.viii.2001, leg. Houhun Li & Xinpu Wang, genitalia slide no. ZAH03773.

Description. Wingspan 14.0 mm. Vertex with brown scales between antennae. Antenna brown. Labial palpus white mixed with brown; second segment with long scales; third segment projecting forward. Thorax brown; tegula with basal half light



Figs. 1–2. *Rhopalovalva ovata* sp. n. **1.** Adult (♂). **2.** Male genitalia.

brown, apical half grey. Forewing pale yellow, without distinct spots and fasciae; apex protruded, outer margin concave below apex; costa with eight pairs of grey streaks ranging from 1/5 to apex , apical five pairs running to termen below apex; cilia pale yellow. Hindwing and cilia grey. Foreleg light brown; midleg and hindleg grey, with light brown scales on tarsi.

Male genitalia. Tegumen posteriorly with long V-shaped lateral sclerite supporting tuba analis. Uncus slender, thin, with slightly thinner apex; socius nearly ovate, setose, longer than uncus. Valva broad at base; neck distinct; sacculus angle with short and broad, straight-ended setose lobe directed dorsad; cucullus somewhat elliptic, setose, with short marginal spines and short clubbed process on triangular projection ventrally. Aedeagus thin, conical; with numerous cornuti.

Female. Unknown.

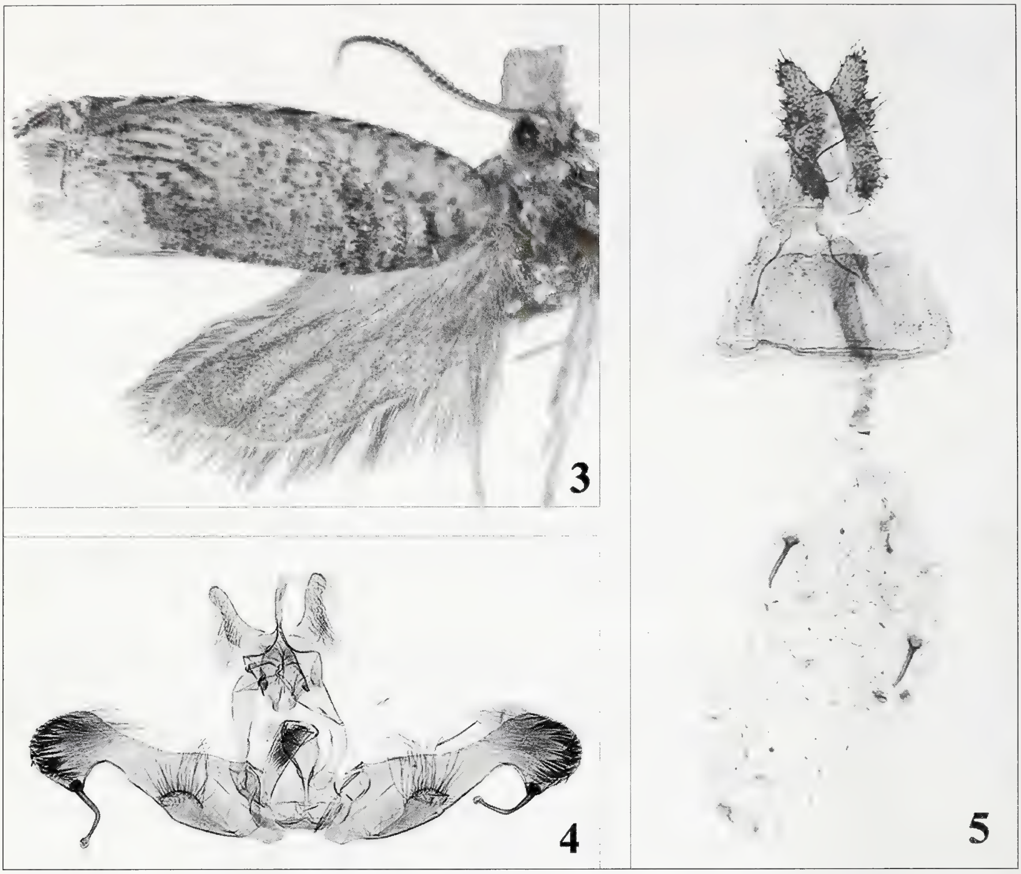
Diagnosis. This species is different from any other species of the genus in having the socius nearly ovate and the cucullus with a short clubbed process on a triangular projection ventrally; in the other species the socius is long and narrow and the cucullus bears a spine or slender process ventrally.

Derivatio nominis. The specific name is derived from the Latin "*ovatus*" (oval), referring to the nearly ovate socius in the male genitalia.

Rhopalovalva orbiculata sp. n. (Figs. 3, 4, 5)

Material. Holotype ♂, Mt. Mao'er (25°53' N, 110°25' E), Guangxi Province, 1100 m, 20.iv.2002, leg. Shulian Hao & Huaijun Xue, genitalia slide no. ZAH03720. Paratypes: 1♂, same data as holotype; 1♀, Mt. Fanjing (27°55' N, 100°41' E), Guizhou Province, 1300 m, 2.viii.2001, Houhun Li & Xinpu Wang; 1♂, 1♀, Xishui County (28°19' N, 106°12' E), Guizhou Province, 1200 m, 1.vi.2000, Yanli Du.

Description. Wingspan 10.0–12.0 mm. Vertex with brown scales. Antenna brown. Labial palpus white mixed with brown; second segment with long scales; third segment minute, concealed in scales of second segment. Thorax fulvous; tegula with basal half light brown, apical half grey. Forewing fulvous, with dark brown transverse lines; apex strongly protruded, falcate; outer margin deeply concave below apex; costa with seven pairs of grey streaks, apical two pairs meeting with each other and running



Figs. 3–5. *Rhopalovalva orbiculata* sp. n. **3.** Adult, ♀. **4.** Male genitalia. **5.** Female genitalia.

to termen below apex; basal 1/3 of dorsum with four unconspicuous tranverse fasciae; tornal marking elliptic, yellow; cilia grey. Hindwing and cilia grey. Legs pale white, with brown scales on tarsi. Abdomen light brown.

Male genitalia. Uncus somewhat clubbed, setose, with apex slightly broadened; socius oblong, broader at base, gradually narrowed beyond middle, as long as uncus, setose. Valva broad at base; neck only slightly narrower than base; sacculus with short, apically rounded setose lobe directed dorsad; cucullus nearly ovate, setose, ventrally with slender process roundly dilated distally. Aedeagus thin, tubular; with numerous cornuti.

Female genitalia. Papillae anales long and narrow, setose. Posterior apophysis slightly shorter than anterior apophysis, both shorter than papillae anales. Ostium opening on posterior margin of 7th sternite. Antrum long, about half length of ductus bursae. Ductus bursae slender; ductus seminalis originating from near corpus bursae. Corpus bursae irregularly elliptic; two signa slender, spined.

Diagnosis. This species is closely related to *Rhopalovalva lascivana* (Christoph) in external appearance, but differs from the latter in having the uncus slightly broadened apically and the socius about equal in length to the uncus, whereas in the other species the uncus is pointed apically and the socius is much longer than the uncus.

Derivatio nominis. The specific name is derived from the Latin "*orbiculatus*" (meaning round), referring to the cucullus of the male genitalia ventrally bearing a slender process roundly dilated distally .

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E. García-Barros, M. L. Munguira, J. Martín Cano, H. Romo Benito, P. Garcia-Pereira & E. S. Maravalhas 2004. Atlas de las mariposas diurnas de la Península Ibérica e islas Baleares (Lepidoptera: Papilionoidea & Hesperioidea). – Monografias Sociedad Entomológica Aragonesa **11**: 228 pp. (ISBN 84-932807-5-5). (in Spanish and English)

The very recently published atlas of the butterflies from the Iberian Peninsula and the Balearic islands is the result of a collaborative work by six authors and 33 further contributors. The atlas starts with a brief introduction, listing the contributors, giving acknowledgements and the financial supports. It is followed by a material and method chapter, which describes the data sources, how the data have been collected in a database, nomenclatural aspects, how the maps have been plotted and it is concluded with a statement on the state of the art. On pages 18–21 follows a list of the species which also refers to the map and page at which each species is treated (there is no separate index at the end). The main chapter (p. 22–72) contains the text for each species which is short and explanatory, primarily devoted to any outstanding problem not visible in the map. The text is written bilingual in Spanish and English throughout, formatted into two columns. The pages 73–184 contain the 224 maps, two maps on each A4 page. Altogether, 290.000 records based on more than 421,000 specimens are plotted on these maps with a 10×10 km grid of the UTM projection system. The book is completed with a regional and a general bibliography (p. 185–224), and thematic maps at the end show the administrative regions and provinces of Portugal and Spain, locations of the main mountain regions and the 100 km UTM squares of the area. The work is precisely presented, as the authors describe exactly what the did. Information gaps ('deserts of butterfly faunistic information') from Andalusia, southern Portugal, Castilla-La Mancha and southern Aragon are mentioned in the text and illustrated in fig. 3 (p. 17). I recommend this atlas to anyone interested in Mediterranean butterflies, especially Iberian and Balearic species.

The atlas gives a comprehensive overview of the known occurrence of each species and a comprehensive bibliography, and will certainly become a standard publication for all who are studying and conserving the butterflies from Portugal, Spain and the Balearic islands.

Matthias Nuss

Description of the female of *Notocelia punicana* Kuznetzov, 1956 (Tortricidae: Olethreutinae)

HELEN ALIPANAH

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Abstract. The female of *Notocelia punicana* Kuznetzov, 1956 is described based on three females collected in the central part of Iran (Yazd province). Females are very similar to males in size and wing pattern. The female genitalia of this species can be separated from those of all other known west Palaearctic species by having broad papillae anales, a very strong eighth tergite, and a peculiar sterigma. In other *Notocelia* species, the sterigma is broader and longer, with well developed, proximally rounded anteostial section.

Key words. Lepidoptera, Tortricidae, Olethreutinae, *Notocelia punicana*, female, Iran.

Notocelia Hübner, [1825] comprises 20 species in the Palearctic region (Razowski 1989). *Notocelia punicana* was described by Kuznetzov (1956) from material collected in Kopet-Dagh (Kara Kala), Turkmenistan. The description was based on males only and the female remained unknown since then. During a survey conducted on the pest fauna of pomegranate (*Punica granatum*, Lythraceae) orchards in Yazd and Ghom provinces in Iran from 2000–2001, males and females of *N. punicana* were found. A redescription of the species is given below, with a description of the female genitalia and a comparison with closely related species.

Notocelia punicana Kuznetzov, 1956

Material. 1P, 3P Iran, Yazd province, Yazd, vii.2000, H. A. Ahmadian leg. (on pomegranate tree).

Description. Head. Vertex and upper frons light brown; labial palpus light brown, with some darker scales in apical segment; ocellus as six shining dark brown spots; antennae brown. Mesonotum light brown; tegulae brown.
Forewing (Fig. 1). Forewing length 7.0 mm (measured from base to apex, including fringes); male and female similar in ground color and pattern of both fore- and hindwings; forewing upperside ground color pale brownish intermixed with cream, with dark brown and orange scales arranged in perpendicular lines; pattern elements including two distinct brown fasciae (basal and subbasal), each surrounded by two dark brown lines, a creamy-white interfascial spot, white costal strigulae of which basal and subbasal confluent to form patch, a light brown to orange pretornal spot, a light brown median fascia, and a brownish orange terminal fascia; fringes brown; forewing underside light brown except white costal strigulae.
Hindwing. Upperside uniformly brown except where forewing overlaps anterior to SC+R1; underside uniformly brown, concolorous with forewing underside.

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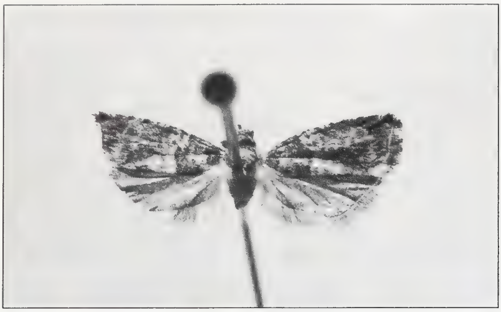


Figs. 1. *Notocelia punicana* from Iran

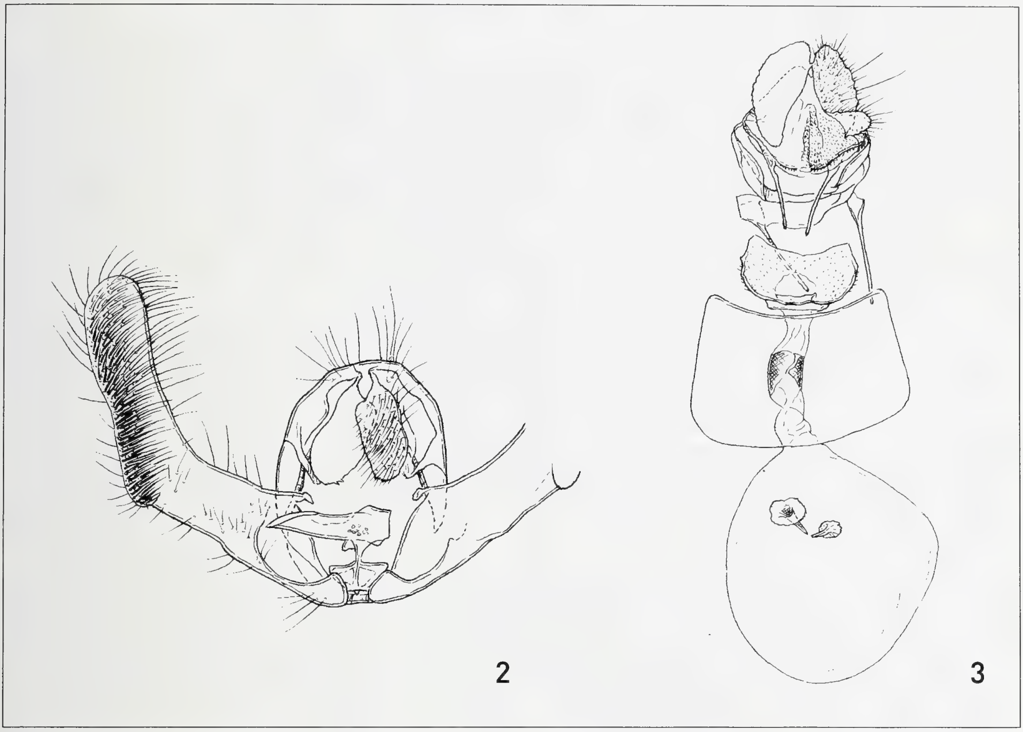
Male genitalia (Fig. 3). Tegumen rather short, broad; socius very large, expanding beyond naked base, especially beyond it internally; remnants of gnathos as slender, fairly long sclerites; valva long with weak ventral depression and rather broad neck; cucullus long, somewhat protruding ventro-proximally; aedeagus slender, with both deciduous and non-deciduous cornuti; the fixed cornuti with a pair of posterior spines, the deciduous cornuti are situated rather in middle of vesica.

Female genitalia (Fig. 4). Papilla analis broadest near middle, rather slender, tapering anteriorly; eighth tergite large with well sclerotized lateral folds; apophyses short; sterigma broad, moderately short with small median anteostial section, large ostium area, and weakly concave posterior edge; lateral edges of sterigma convex; ductus bursae moderately long; cingulum large, medially located; signa unequally sized.

Diagnosis. Externally, this species is similar to *N. trimaculana* (Haworth, [1811]) (= *N. suffusana* Zeller, 1846) and was originally compared with that species (Kuznetzov 1956). As in *N. rosaecolana* (Doubleday, 1850), males have no groups of melanic scales on the hindwing. The Iranian specimens have rather slenderer forewings than the populations of both above-mentioned European species. Their pattern is seemingly more strongly strigulated. The male genitalia are characterized by the very broad socii and long cucullus. This species differs in the lack of a terminal pair of non-deciduous cornuti and the horn-like process beyond the basal cavity of the valva. The female is quite different from all known west Palaearctic species in having broad papillae anales, a very strong eighth tergite, and a peculiar sterigma. The last character is similar in *Barbara herrichiana* Obraztsov, 1960, but it is broader and more concave posteriorly. In other *Notocelia* species the sterigma is broader and longer, with a well developed, proximally rounded anteostial section.

Life history. The reddish larvae of this species were collected for the first time under the bark of pomegranate trees (*Punica granatum*, Lythraceae) in the above-mentioned areas during April-May 2000. They feed on reproductive organs of flowers and cause the premature fall of the fruits.

Remarks. This is the first record of *N. punicana* from Iran. The external characters confirm the inclusion of this species in *Notocelia*. However, the lack of non-deciduous cornuti and the structure of the ovipositor and sterigma are possibly unique in this genus.



Figs. 2–3. *Notocelia punicana* from Iran. **2.** Male genitalia. **3.** Female genitalia.

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I wish to express my cordial thanks to Prof J. Razowski (Institute of Systematics and Evolution of Animals, Polish Academy of Sciences, Kraków) for his very kind help, his comments on the manuscript, and for redrawing the illustrations. I am also grateful to Prof V. I. Kuznetzov (Zoological Institute, St. Petersburg) for his helpful guidance. I am also thankful to Dr. S. Manzari (Plant Pests and Diseases Research Institute, Tehran) for editing the text.

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Revision of the *Turanana endymion* species-group (Lycaenidae)

John G. Coutsis

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Abstract. The separation of *Turanana taygetica* (Rebel, 1902) stat. n. from *Turanana endymion* (Freyer, 1850) is effected on the basis of small, but constant differences in their male genitalia, the absence of genitalia intermediates, as well as on the basis of syntopism and synchronism of these two species-group taxa in south-central Asiatic Turkey. *Turanana taygetica endymionoides* ssp. n. is described on the basis of constant and rather pronounced external differences. A male neotype is designated for nominotypical *endymion*, as well as for nominotypical *T. taygetica*. A male lectotype is designated for *T. endymion ahasveros* (Bytinski-Salz & Brandt, 1937).

Key words. Lycaenidae, *Turanana endymion*, taxonomy, typification, new subspecies, Greece, Turkey, Iran.

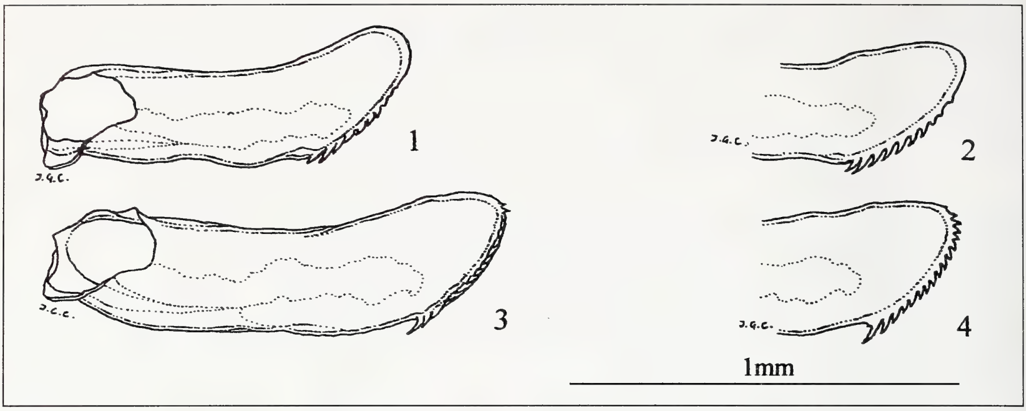
Introduction

A comparison between the valvae of *Turanana endymion endymion* (Freyer, 1850) (= *T. panagaea panagaea* (Herrich-Schäffer, 1851)) from central and eastern Asiatic Turkey (Figs. 1, 2, 5, 7–26, 27–33, 39–50), as well as from Lebanon (Fig. 34), and between the valvae of what is generally accepted as being *Turanana endymion ahasveros* (Bytinski-Salz & Brandt, 1937) from Iran (Fig. 38), and those of *Turanana endymion taygetica* (Rebel, 1902) from Mt. Helmós (Figs. 3, 4, 6, 52) and Mt. Taíyetos (Fig. 51), both situated in Pelopónnisos, Greece, revealed small, but constant differences in the average number and especially in the arrangement of their terminal spikes (Coutsis 1986). It was then suggested that possibly two separate species were involved here, but due to allopatry and the small degree of differentiation between them, it was deemed more appropriate to retain them as separate subspecies only.

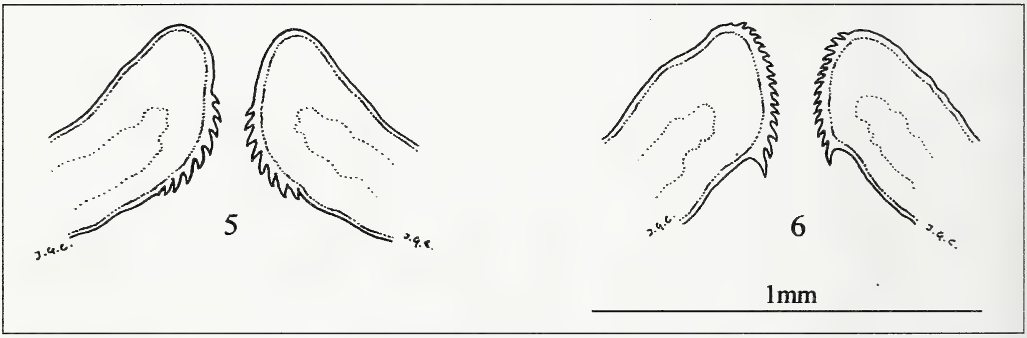
Recent material of *T. endymion* from western Asiatic Turkey, however, demonstrated that their valvae were identical to those of subspecies *T. taygetica* (Figs. 53–65, 66–87), while specimens collected as syntopic and synchronous on Bolkardağları, Niğde province, south-central Asiatic Turkey, were found to possess either one or the other valval type (Figs. 7, 64), without the presence of intermediates.

These conditions seemed important enough to necessitate a reassessment of the hitherto accepted taxonomic relationship between *endymion* and *taygetica*, as well as to warrant a revision, albeit tentative (due to lack of sufficiently extensive material), of the *T. endymion* species-group as a whole.

The name *Turanana endymion endymion* is now provisionally being applied to all specimens that possess valvae that are identical to those of specimens recorded from the type locality of *endymion*, i.e.: Turkey, Amasya province (Figs. 9, 10), the name *Turanana endymion ahasveros* to all specimens that possess valvae that are identical to those of specimens recorded from the type locality of *ahasveros*, i.e.: Iran, Elburs Mts., Keredj (Figs. 35–37), and the name *Turanana endymion taygetica*, to all specimens whose valvae are identical to those of specimens recorded from the type locality of



Figs. 1–4. *Turanana endymion* and *Turanana taygetica*, aspects of right valva for specimens of near equal forewing length. **1.** *T. endymion endymion*, Turkey, Sivas province, Gökpınar, 1600 m (forewing length 11.7 mm), side view of inner face. **2.** Same specimen, view on mesal side, showing distal end. **3.** *T. taygetica endymionoides* (formerly *T. endymion taygetica*), Greece, Pelopónnisos, Mt. Helmós, 1800 m (forewing length 11.2 mm); side view of inner face. **4.** Same specimen, view on mesal side, showing distal end.

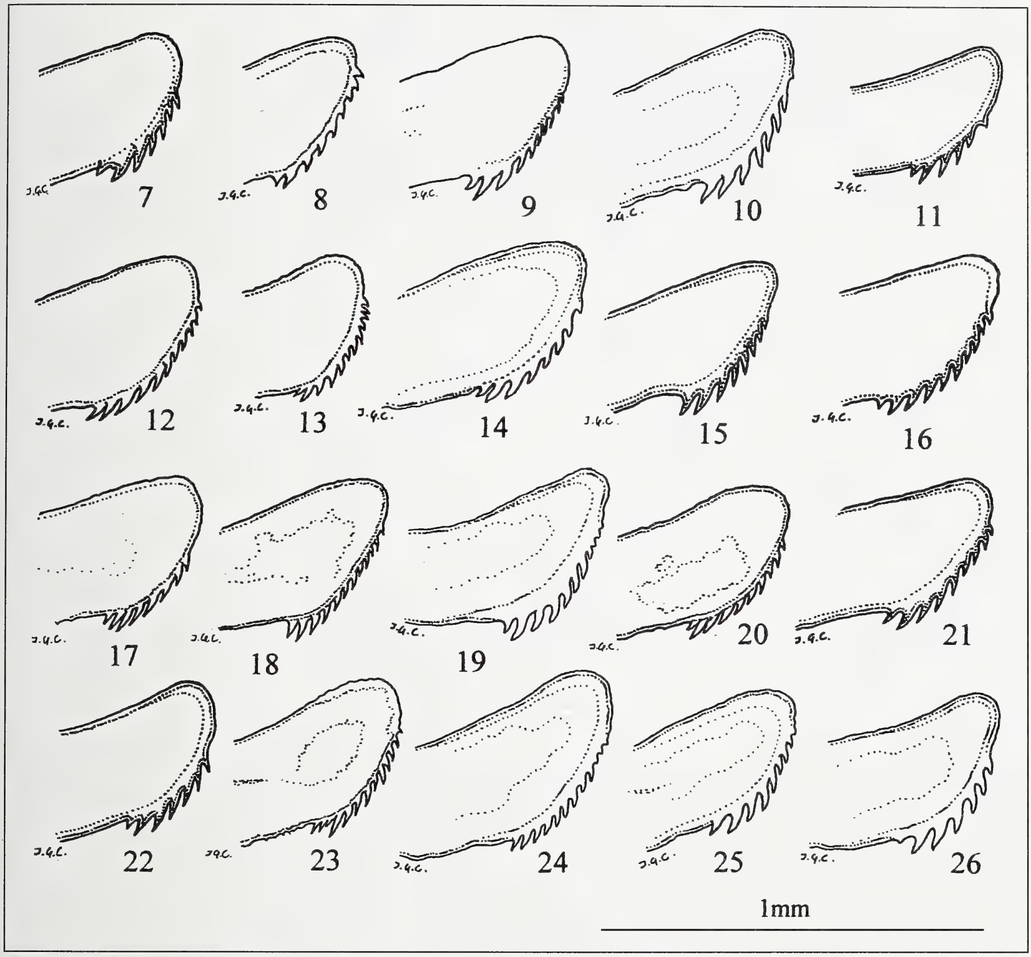


Figs. 5–6. *Turanana endymion* and *Turanana taygetica*, view on distal end of mesal wall of right and left valva, showing the near symmetry of the appendages. **5.** *T. endymion endymion*. Turkey, Sivas province, S of Gürün, Gökpınar, 1500–1650 m. **6.** *Turanana taygetica endymionoides* (formerly *T. endymion taygetica*), Greece, Pelopónnisos, Mt. Helmós, 1800 m.

taygetica, i.e.: Greece, Pelopónnisos, Mt. Taíyetos (Fig. 51). Two specimens from Mazanderan, Iran (the valva of one is shown on Fig. 38), which externally agree with *ahasveros*, but whose genitalia are identical to those of nominotypical *endymion* and differ from those of the subspecies *ahasveros*, are provisionally being referred to as *Turanana endymion* ?-*ahasveros*.

Abbreviations

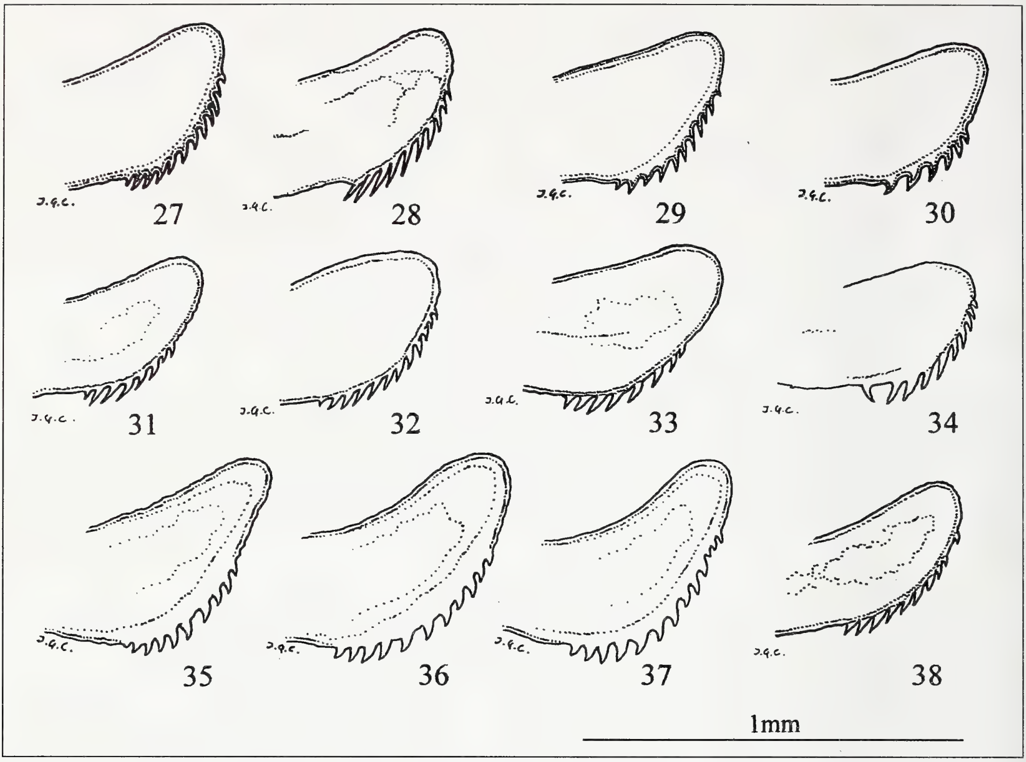
BMNH	The Natural History Museum, London
CMNH	Carnegie Museum of Natural History, Pittsburgh, Pennsylvania
NHRS	Naturhistoriska Riksmuseet, Stockholm
ZMAN	Zoölogisch Museum, Universiteit van Amsterdam



Figs. 7–26. *Turanana endymion endymion* from Turkey, view of distal end of mesal wall of right valva. **7.** Niğde province, Bolkardağları N side, SW of Maden, 1600–1800 m. **8.** Niğde province, Aladağları W side, 15 km SE of Çamardı, Elmalı Boğazı, 1600–1800 m. **9.** Amasya province. **10.** Amasya province, 10 km SW of Ladik, 900 m. **11.** Kayseri province, Hisarcık, road between Develi and Kayseri town, 1800 m. **12.** Kayseri province, Ercıyes Dağ, road between Develi and Kayseri town, 2200 m. **13.** Kayseri province, Aladağları E side, 48 km S of Yahyalı, 2800–2900 m. **14.** Tokat province, near Çamıçı, 1200 m. **15.** Ordu province, 20 km NNW of Mesudıye, 900 m. **16.** Maraş province, hills NW of Maraş town, 5–10 km along road to Ağabeylı, 800–900 m. **17.** Sivas province, near Gökpınar, 10 km S of Gürün, 1500 m. **18.** Sivas province Çamlıbel Geçidi, 1450 m. **19.** Malatya province, 3 km SE of Kubbe Geçidi, 1700 m. **20.** Malatya province, 3–6 km NW of Darende, 1500 m. **21.** Erzincan province, Dumanlı, 10–13 km SW of Erzincan town, along road to Kemah, 1100 m. **22.** Gümüşhane province, Demirkaynak, 2–5 km along road to Şırnak, 1100 m. **23.** Erzincan province, 5 km S of Çağlayan, Munzurdağları. **24.** Erzincan province, Sakaltutan Geçidi, 25 km E of Refahiye, 2000 m. **25.** Tunceli province, 1200 m. **26.** Elazığ province, near Harput, N of Elazığ town, 1200 m.

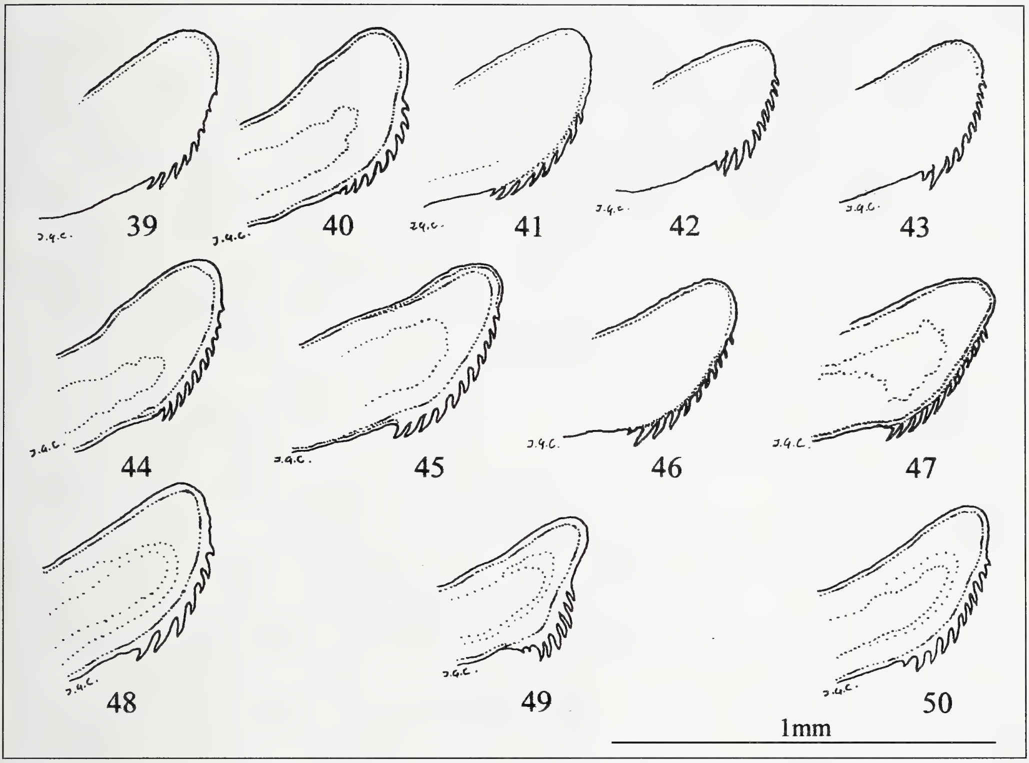
Proposed new nomenclatural arrangement

The constant differences between the valvae of nominotypical *endymion* and those of the subspecies *taygetica*, the syntopism and synchronism of their respective populations in south-central Asiatic Turkey and the absence of intermediate valval forms suggest that it would be better to consider them as representing two distinct species, rather than



Figs. 27–38. *Turanana endymion*, view of distal end of mesal wall of right valva. **27–34.** *T. endymion endymion*. **27.** Turkey, Gümüşhane province, Kopdağı Geçidi W side, 1900 m. **28.** Turkey, Erzurum province, Ovit Geçidi, 10–15 km NW of İspir, 1500–1800 m. **29.** Turkey, Erzurum province, Palandöken, 5 km S of Erzurum town, 2200 m. **30.** Turkey, Artvin province,Sarıbudak, 800 m. **31.** Turkey, Van province, near Edremit, 17 km SW of Van town. **32.** Turkey, Van province, Çatak. **33.** Turkey, Hakkâri province, 10–12 km SW of Hakkâri town, Zap valley, 1500 m. **34.** Lebanon, Mt. Lebanon. **35–37.** *T. endymion ahasveros*. **35.** Iran, Fars, road from Ardekan to Talochosroe, Comèe, ca. 3600 m. **36.** Iran, Fars, road from Chiraz to Kazeroun, Fort Sine-Sefid, ca. 2200 m. **37.** Iran, Elburs Mts., Keredj, 1700 m. **38.** *T. endymion ?-ahasveros*, Iran, Mazanderan, Khosh-Yeylaq, 2000–2500 m.

two subspecies of the same species. The taxon *ahasveros*, differing from nominotypical *endymion* by its extended valval apex, may very well represent yet another species, but it is at present best to consider it as a subspecies of *endymion* on account of the fact that there was no material available for study from geographically intermediate areas (perhaps *ahasveros* might prove to be the end expression of a cline) and also because certain individuals of nominotypical *endymion* likewise show a tendency towards an extension of the valval apex (Figs. 19, 26). The taxon *?-ahasveros* from Mazanderan, Iran, requires the study of presently unavailable further material from other localities in Iran, in order for one to be able to draw sound conclusions about its true taxonomic status. Mt. Helmós *taygetica*, clearly differing externally from the nominotypical form from Mt. Taíyetos (to be dealt with in detail in the ensuing description of the type-material), rightfully deserves separation from it at the subspecies level. Macroscopic comparison of Turkish *taygetica* with nominotypical *endymion* did not reveal constant external differences, but the material at hand was probably not sufficient enough in

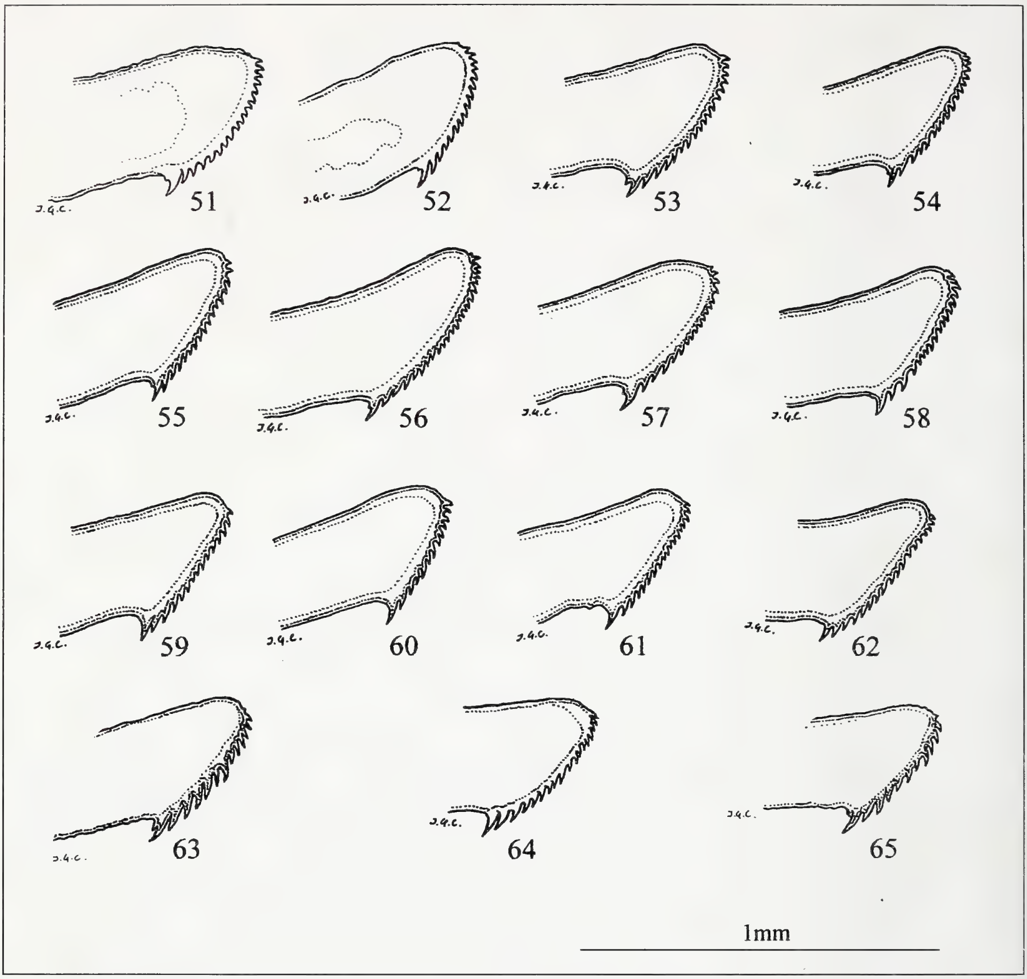


Figs. 39–50. *Turanana endymion endymion*, view of distal end of mesal wall of right valva, demonstrating individual variation within single localities in Turkey. **39–47.** Sivas province, Gökpınar. **48–50.** Erzincan province, Çağlayan.

numbers to allow definitive conclusions. Mt. Helmós *taygetica* on the whole differs externally to some extent from its Turkish counterpart, but as certain individuals are very difficult to set apart and as specimens from geographically intermediate areas (i.e. western extremity of Asiatic Turkey) were not available for study, it seems presently prudent to lump them together under a single subspecies, albeit on a tentative basis. On account of the above, it is proposed that the following taxonomic arrangement be put to effect.

Available type material and type designations

The syntypes of *T. endymion endymion* have been lost and therefore a male specimen from the type locality has been chosen to be designated as the neotype. A number of syntypes of *T. endymion ahasveros* have been made available from the Naturhistoriska Riksmuseet, Stockholm, Sweden and a male specimen has been chosen to be designated as the lectotype, while the rest of the syntypes (4 males and 1 female from the above museum and 5 males and 5 females deposited in the Carnegie Museum, Pittsburgh, Pennsylvania, USA) are designated as paralectotypes. A thorough personal search for the syntypes (one male and two females) of *T. taygetica taygetica* at their depository in the Naturhistorischen Hofmuseum, Wien, Austria, brought about negative results and it is assumed that they too have been lost, thus making it necessary that a male specimen from the type locality be designated as the neotype. Lastly, a male holotype and paratypes of both sexes, all from the author's collection, are designated for *T. taygetica endymionoides*, and the necessary descriptions given below.

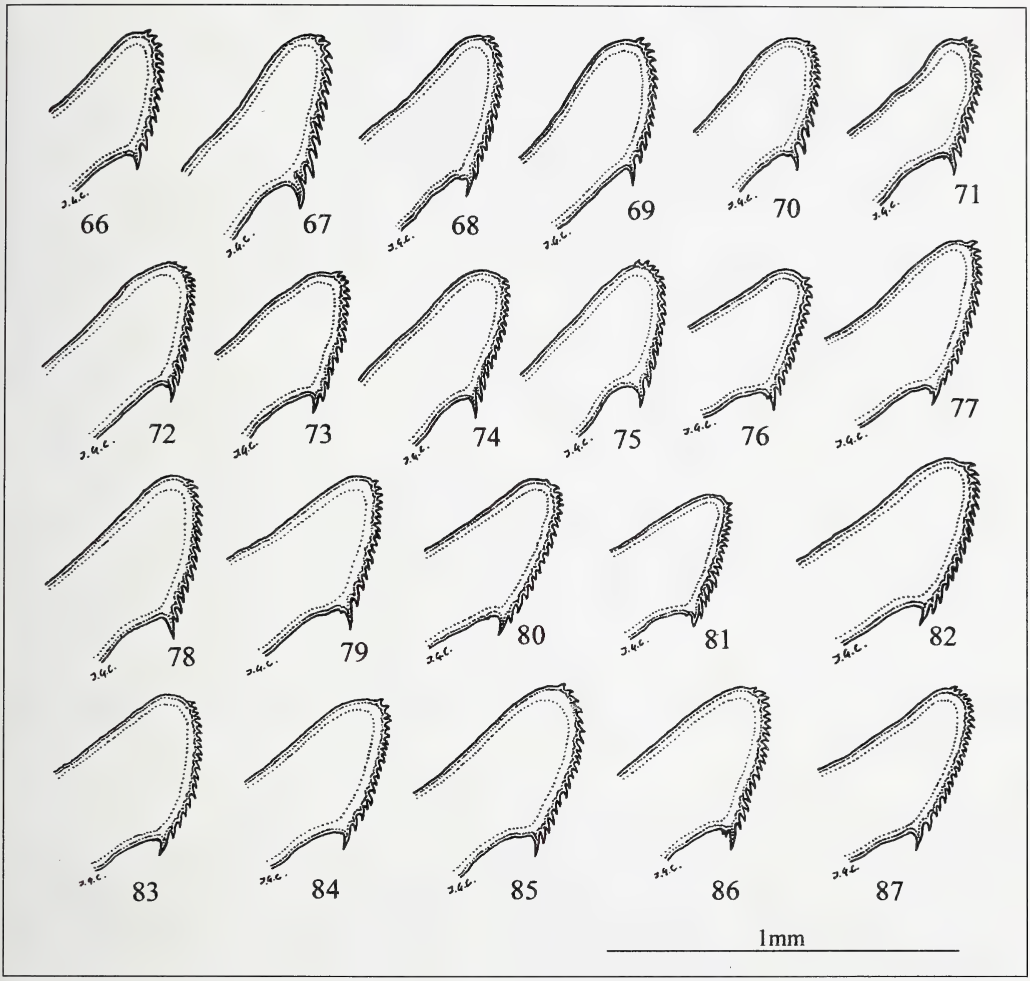


Figs. 51–65. *Turanana taygetica* (formerly *Turanana endymion taygetica*), view of distal end of mesal wall of right valva. **51.** *Turanana taygetica taygetica*. Greece, Pelopónnisos, Mt. Taíyetos, 1150–1200 m. **52–65.** *Turanana taygetica endymionoides*. **52.** Greece, Pelopónnisos, Mt. Helmós, 1800 m. **53.** Turkey, Konya province, Sultandağları, 15 km S of Akşehir, 1500 m. **54.** Turkey, Konya province, 12 km SW of Engilli, 1300–1600 m. **55.** Turkey, Konya province, 10 km NE of Gelendost, 1000 m. **56.** Turkey, Afyon province, Sultandağları, 10 km S of Çay, 1300 m. **57.** Turkey, Afyon province, Sultandağları, 8 km SW of Dereçine, 1700–2200 m. **58.** Turkey, Konya province, Sultandağları, 6km S of Çankaturan, 23km SSE of Akşehir, 1700m. **59.** Turkey, Konya province, Sultandağları, Akşehir, 1100 m. **60.** Turkey, Konya province, Derebucak, 1100 m. **61.** Turkey, Karaman province, Sertavul Geçidi, 1500 m. **62.** Turkey, Konya province, Akşehir, 1900 m. **63.** Turkey, Niğde province, Aladağları E side, 10 km S of Yahyalı, 1800–1900 m. **64.** Turkey, Niğde province, Bolkardağları N side, near Maden, 1500–1650 m. **65.** Turkey, Kayseri province, Aladağları E side, 2800–2900 m, 18 km S of Yahyalı.

Turanana endymion endymion (Freyer, 1850)

Pap.[*ilio*] *Endymion* Freyer, 1850: 145–146, pl. 572 figs. 2, 3. Type locality: Turkey, Amasia. (original description: see Figs. 89–91). Syntypes: lost.

Material. Neotype. ♂ designated here (Figs. 92–96), **Turkey**, Amasya province, 10 km SW of Ladik, 900 m, 2.vi.1988 (gen. prep. no. 3740), H. & Th. v. Oorschot, H. v. d. Brink & H. Wiering leg., coll. ZMAN. – 1♂ Turkey, Amasya province, coll. BMNH; 1♂ Amasya province, 10 km SW of Ladik, 900 m,



Figs. 66–87. *Turanana taygetica endymionoides* (formerly *Turanana endymion taygetica*), view of distal end of mesal wall of right valva, demonstrating individual variation within the single locality in Turkey, Sultandağları mountain range, provinces of Konya and Afyon.

2.vi.1988, coll. ZMAN; 1♂ Artvin province,Sarıbudak, 800 m, 19.vii.1993, coll. De Prins, Olivier & v. d. Poorten; 1♂ Elazığ province, near Harput, N of Elazığ town, 1200 m, 8.vii.1987, coll. ZMAN; 1♂ Erzincan province, Dumanlı, 10–13 km SW of Erzincan town, along road to Kemah, 1100 m, 12.vi.1988, coll. De Prins, Olivier & v. d. Poorten; 3♂ Erzincan province, 5 km SE of Çağlayan, 1500 m, 5.vii.1999, coll. Wiemers; 1♂ Erzincan province, 5 km S of Çağlayan, Munzurdağları, 15–18.vii.1987, coll. De Prins, Olivier & v. d. Poorten; 1♂ Erzincan province, Sakaltutan Geçidi, 25 km E of Refahiye, 2000 m, 13.vii.1986, coll. ZMAN; 1♂ Erzurum province, Ovit Geçidi, 10–15 km NW of İspir, 1500–1800 m, coll. De Prins, Olivier & v. d. Poorten; 1♂ Erzurum province, Palandöken, 5 km S of Erzurum town, 2200 m, 5.vii.1993, coll. De Prins, Olivier & v. d. Poorten; 1♂ Gümüşhane province, Demirkaynak, 2–5 km along road to Şırnak, 1100 m, 25.vii.1992, coll. De Prins, Olivier & v. d. Poorten; 1♂ Gümüşhane province, Kopdağı Geçidi W side, 1900 m, 28.vii.1987, coll. De Prins, Olivier & v. d. Poorten; 1♂ Hakkâri province, 10–12 km SW of Hakkâri town, Zap valley, 1500 m, 16–25.vii.1990, coll. De Prins, Olivier & v. d. Poorten; 1♂ Kayseri province, Hisarcık, road between Develi and Kayseri town, 1800 m, 6.vii.1982, coll. De Prins, Olivier & v. d. Poorten; 1♂ Kayseri province, Ercıyes Dağ, road between Develi and Kayseri town, 2200 m, 22.vii.1995, coll. De Prins, Olivier & v. d. Poorten; 1♂ Kayseri province, Aladağları E side, 48 km S of Yahyalı, 2800–2900 m, 28.vii–2.viii.1995, coll. De Prins, Olivier & v. d. Poorten; 1♂ Malatya province,

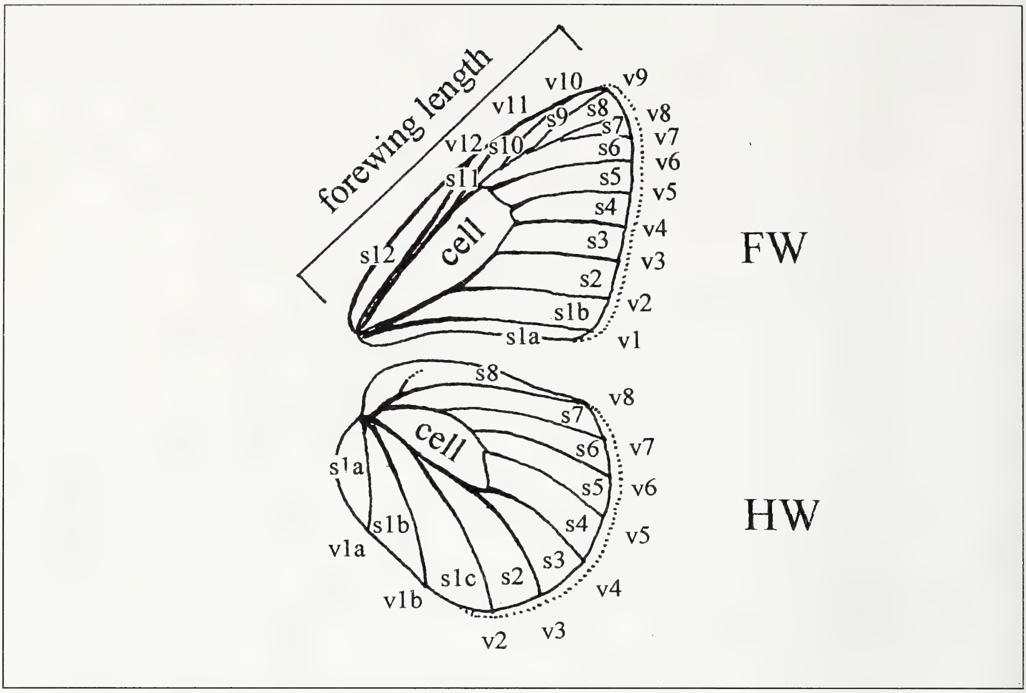
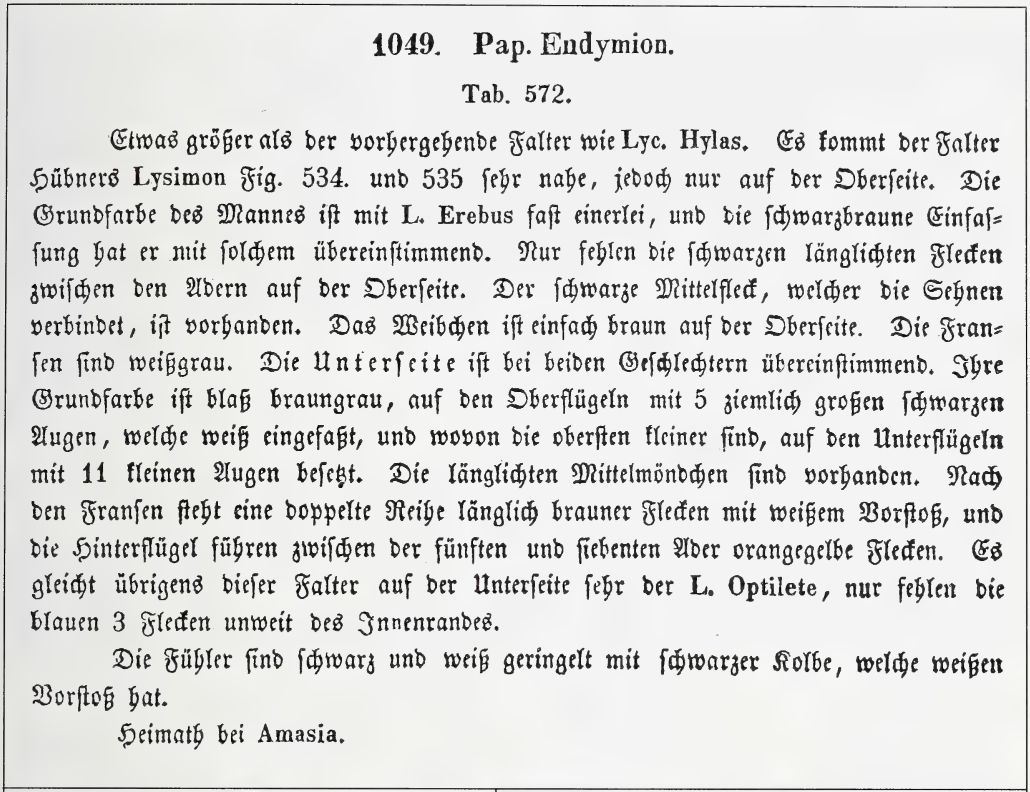


Fig. 88. Scheme of the butterfly wings, defining "forewing length", and showing the cell, the veins and the inter-venal spaces of the fore- and hindwing.

3 km SE of Kubbe Geçidi, 1700 m, 12.vi.1999, coll. ZMAN; 1♂ Malatya province, 3–6 km NW of Darende, 1500 m, 30.vii–3.viii.1983, coll. De Prins, Olivier & v. d. Poorten; 1♂ Maraş province, hills NW of Maraş town, 5–10 km along road to Ağabeylı, 800–900 m, 29.v.1985, coll. De Prins, Olivier & v. d. Poorten; 1♂ Niğde province, Bolkardağları N side, SW of Maden, 1600–1800 m, 24.vii.1994, coll. De Prins, Olivier & v. d. Poorten; 1♂ Niğde province, Aladağları W side, 15 km SE of Çamardı, Elmalı Boğazı, 1600–1800 m, 19.vii.1995, coll. De Prins, Olivier & v. d. Poorten; 1♂ Ordu province, 20 km NNW of Mesudıye, 900 m, 6.vi.1988, coll. De Prins, Olivier & v. d. Poorten; 1♂ Sivas province, Gökpınar, 1600 m, 9–11.vii.1987, coll. Coutsis; 3♂ Sivas province, Gökpınar, 1600m, 10.vii.1982, coll. Coutsis; 1♂ Sivas province, near Gökpınar, 10 km S of Gürün, 1500 m, 10–11.vii.1985, coll. De Prins, Olivier & v. d. Poorten; 4♂ Sivas province, S of Gürün, Gökpınar, 1500–1650 m, 9–11.vii.1982, coll. Coutsis; 1♂ Sivas province, 15 km S of Gökpınar, 1800 m, 2.vi.1999, coll. ZMAN; 1♂ Sivas province Çamlıbel Geçidi, 1450 m, 4.vii.1987, coll. De Prins, Olivier & v. d. Poorten; 1♂ Tokat province, near Çamıçı, 1200 m, 4.vi.1988, coll. ZMAN; 1♂ Tunceli province, 1200 m, 13–14.vii.1987, coll. ZMAN; 1♂ Van province, near Edremit, 17 km SW of Van town, 1–6.vii.1990, coll. Wiemers; 1♂ Van province, Çatak, 2.vii.1991, coll. Coutsis; 1♂ **Lebanon**, Mt. Lebanon, coll. BMNH.

Description. Neotype (Figs. 92, 93). Forewing length 11.1 mm. Upperside ground-colour blue; blackish marginal borders averaging about 1.7 mm wide; blackish border on forewing tending to invade the post-distal area basad of apex; weakly defined pure black spots present in borders in s1c, s2, s3, s4 and s5 of hindwing; apex of cell on forewing marked by a fine, weakly-defined black stria shaped like shallow crescent; fringes pure white. Underside ground-colour light gray-brown, giving impression of "dirty and rough" texture; basal area of hindwing with faint, shiny, whitish-blue dusting; post-discal black spots on forewing large and surrounded by off-white rings; post-discal spot in s3 conspicuously displaced distad; apex of cell on forewing with fine, well-



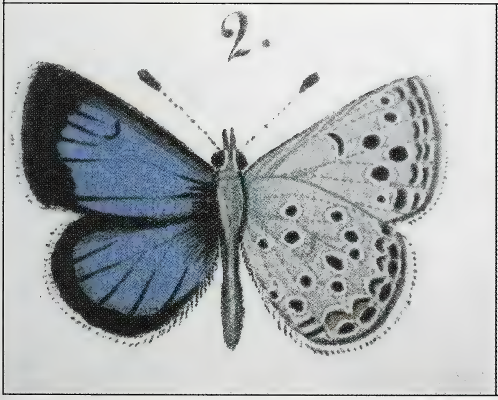
1049. **Pap. Endymion.**

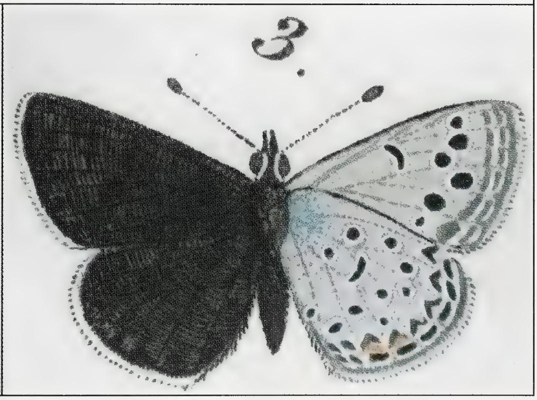
Tab. 572.

Etwas größer als der vorhergehende Falter wie Lyc. Hylas. Es kommt der Falter Hübners Lysimon Fig. 534. und 535 ſehr nahe, jedoch nur auf der Oberſeite. Die Grundfarbe des Mannes iſt mit L. Erebus faſt einerlei, und die ſchwarzbraune Einfaſſung hat er mit ſolchem übereinſtimmend. Nur fehlen die ſchwarzen länglichten Flecken zwiſchen den Adern auf der Oberſeite. Der ſchwarze Mittelfleck, welcher die Sehnen verbindet, iſt vorhanden. Das Weibchen iſt einfach braun auf der Oberſeite. Die Franſen ſind weißgrau. Die Unterſeite iſt bei beiden Geſchlechtern übereinſtimmend. Ihre Grundfarbe iſt blaß braungrau, auf den Oberflügeln mit 5 ziemlich großen ſchwarzen Augen, welche weiß eingefaßt, und wovon die oberſten kleiner ſind, auf den Unterflügeln mit 11 kleinen Augen beſetzt. Die länglichten Mittelmöndchen ſind vorhanden. Nach den Franſen ſteht eine doppelte Reihe länglich brauner Flecken mit weißem Vorſtoß, und die Hinterflügel führen zwiſchen der fünften und ſiebenten Ader orangegelbe Flecken. Es gleicht übrigens dieſer Falter auf der Unterſeite ſehr der L. Optilete, nur fehlen die blauen 3 Flecken unweit des Innenrandes.

Die Fühler ſind ſchwarz und weiß geringelt mit ſchwarzer Kolbe, welche weißen Vorſtoß hat.

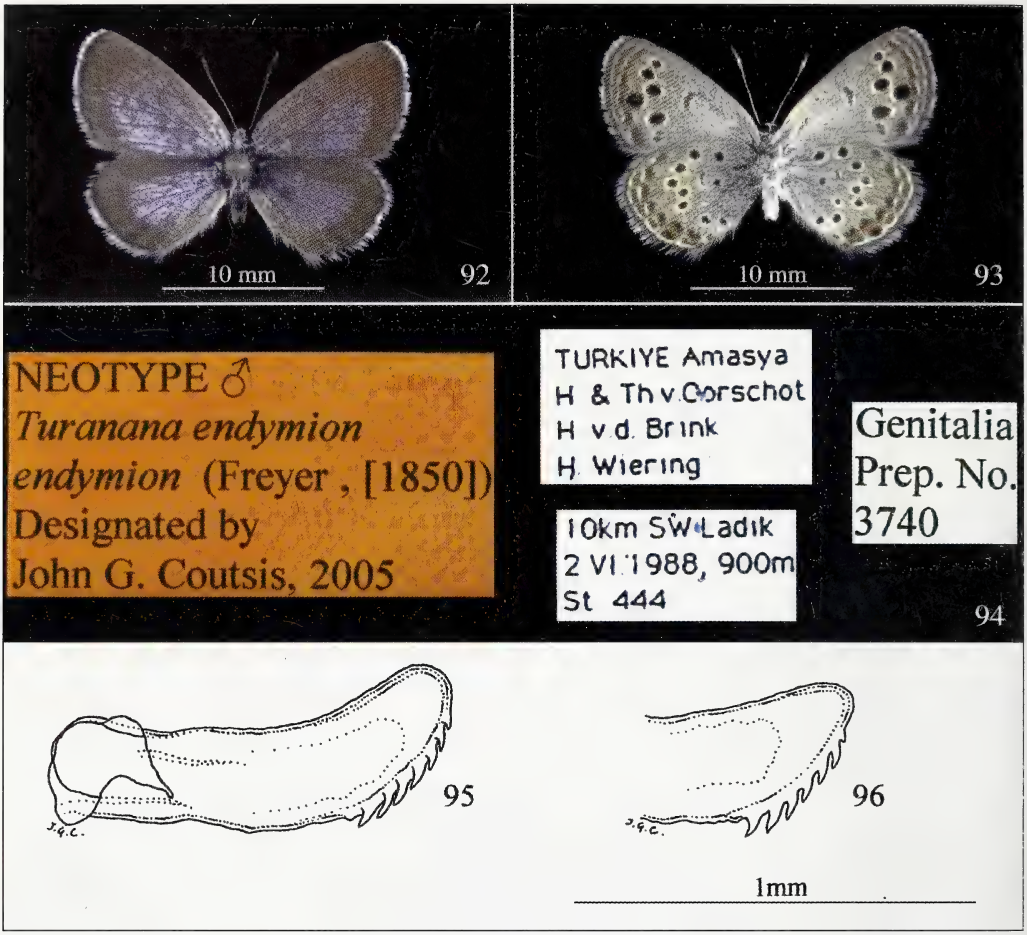
Heimath bei Amasia.





Figs. 89–91. Original description of "Pap.[ilio] Endymion" by Freyer, 1850. **89.** Text on page 145. **90.** Figure of ♂ on pl. 572 fig. 2. **91.** Figure of ♀ on pl. 572 fig. 3.

defined black-brown stria shaped like shallow crescent; both wings with double row of well-defined black-brown sub-marginal markings, the darkest (almost black) and most conspicuous being situated nearest wing margin in s2 of hindwing; space between outer and inner row of dark sub-marginal markings filled with macroscopically conspicuous orange scaling in s1c, s2 and s3 and microscopically discernible orange dusting in s1b, s4 and s5; post-discal black spots on hindwing likewise surrounded by off-white rings,



NEOTYPE ♂
Turanana endymion
endymion (Freyer, [1850])
Designated by
John G. Coutsis, 2005

TURKIYE Amasya
H & Th v.Oorschot
H v.d. Brink
H. Wiering

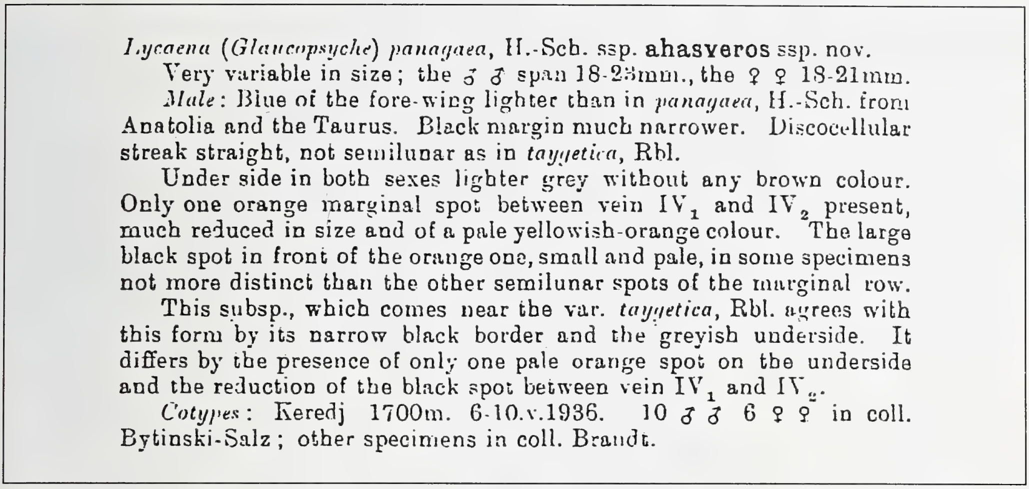
10km SW Ladik
2 VI 1988, 900m
St 444

Genitalia
Prep. No.
3740

Figs. 92–96. *Turanana endymion endymion* (Freyer, 1850), neotype ♂. **92.** Upperside. **93.** Underside. **94.** Data labels. **95.** Male genitalia, view on mesal wall of right valva. **96.** Male genitalia, view on mesal wall of distal end of right valva.

but smaller than their forewing counterparts; apex of cell on hindwing underside with black-brown stria shaped like shallow crescent as in forewing, but about half as long as its forewing counterpart; single black spot enclosed by off-white ring also present in cell of hindwing, just distad of and slightly diagonally to dark stria of cellular apex; fringes pure white. Valva (Figs. 95, 96) 1.26 mm in length, with 7 terminal spikes, most proximal equal in size to next one and most distal situated below apex of valva at distance equal to about ¼ total length of valval distal margin.

Variation. This is expressed in both males and females by their overall size (forewing length from slightly under 10 mm to slightly over 12 mm). In the males in particular it is expressed on their upperside by the width of the blackish marginal borders, the number and intensity of black spots within these borders on the hindwing, the degree of invasion of these borders into the post-distal area of the forewing just basad of wing apex, and the presence, or total absence of the black stria on the hindwing's cell apically.



Lycaena (*Glaucopsyche*) *panagaea*, H.-Sch. ssp. **ahasveros** ssp. nov.

Very variable in size; the ♂♂ span 18-23mm., the ♀♀ 18-21mm.

Male: Blue of the fore-wing lighter than in *panagaea*, H.-Sch. from Anatolia and the Taurus. Black margin much narrower. Discocellular streak straight, not semilunar as in *taygetica*, Rbl.

Under side in both sexes lighter grey without any brown colour. Only one orange marginal spot between vein IV_1 and IV_2 present, much reduced in size and of a pale yellowish-orange colour. The large black spot in front of the orange one, small and pale, in some specimens not more distinct than the other semilunar spots of the marginal row.

This subsp., which comes near the var. *taygetica*, Rbl. agrees with this form by its narrow black border and the greyish underside. It differs by the presence of only one pale orange spot on the underside and the reduction of the black spot between vein IV_1 and IV_2.

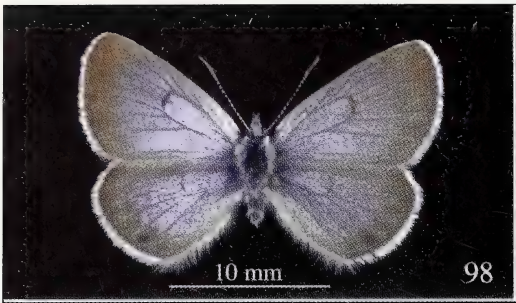
Cotypes: Keredj 1700m. 6-10.v.1936. 10 ♂♂ 6 ♀♀ in coll. Bytinski-Salz; other specimens in coll. Brandt.

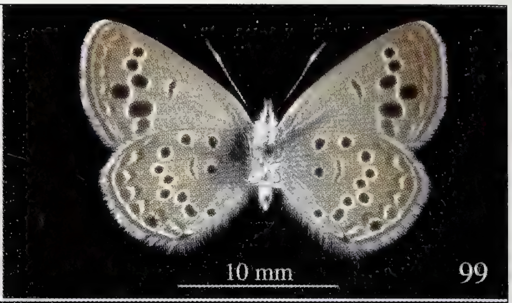
Fig. 97. Original description of "*Lycaena* (*Glaucopsyche*) *panagaea*, H.-Sch. Ssp. *ahasveros* ssp. nov.", by Bytinski-Salz & Brandt, 1937: (1).

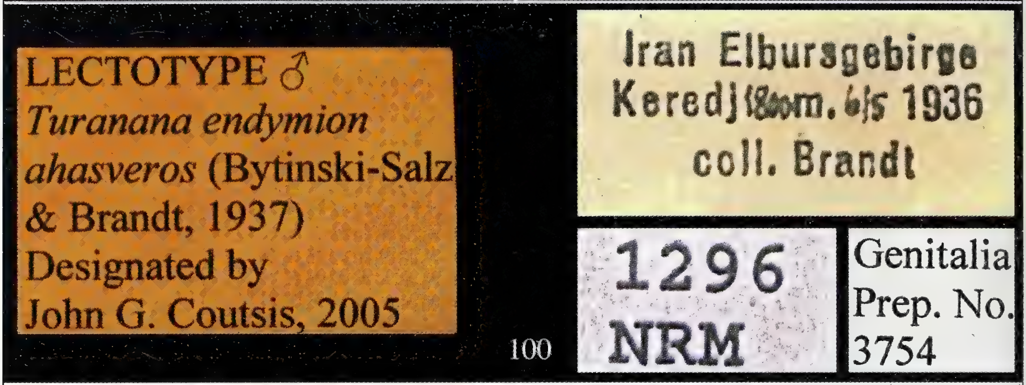
On the underside it is expressed by the spread and intensity of the sub-marginal orange scaling of the hindwing and the degree of shiny, whitish-blue dusting at the base of the hindwing. In the females which are overall dark brown on the upperside and are similar to the males on the underside, exhibiting at the same time similar variation, it is expressed on the upperside by the degree of basal blue scaling (often macroscopically invisible), the presence (in various numbers and different intensities), or total absence, of sub-marginal black spots on the hindwing and the occasional presence of a sub-marginal off-orange spot in s2 (and very rarely in s3) on the hindwing. In the male genitalia it is expressed by the number, spread, and positioning of the valval terminal spikes and by the degree of the valval apex extension.

Male genitalia. Right and left valvae (Fig. 5) roughly symmetrical, as in *endymion taygetica* (Figs. 6), but shorter (Fig. 1) than those of *endymion taygetica* (Fig. 3) for specimens of equal, or near-equal forewing length. Number and placement of terminal spikes very variable (6–13 in number and extending distad from about one half (Fig. 49) to more than two thirds (Fig. 34) length of distal margin of valva). In specimens from within two separate localities spikes varying in number from 7 to 11 (Figs. 39–47 and 48–50 respectively). The three characters that stand out as being constant are the short length of the valva, the fact that the most proximal of its terminal spikes is as a rule shorter than, rarely equal in length to and never longer than the one immediately distad and that the terminal spikes, though extending at times towards the valval apex, never quite reach it. Valvae with the above-described configuration are also illustrated in Higgins (1975), from Lebanon, and in Mattoni (1979), without locality data.

Distribution. *Turanana endymion endymion* (Freyer, 1850) applies to specimens from the eastern half of Asiatic Turkey and Lebanon that possess valvae that are similar to those of topotypical *endymion*. Syntopic and synchronous with *taygetica* in south-central Asiatic Turkey.





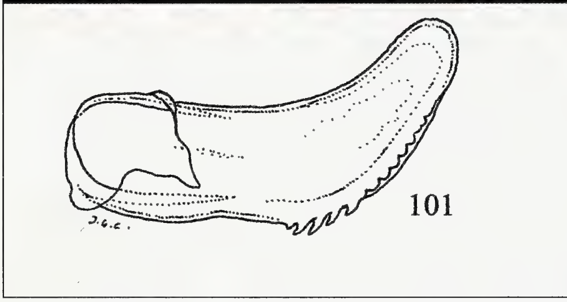


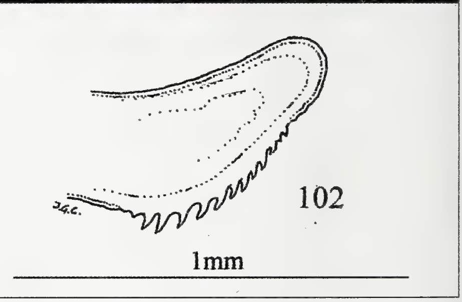
LECTOTYPE ♂
Turanana endymion
ahasveros (Bytinski-Salz
& Brandt, 1937)
Designated by
John G. Coutsis, 2005

Iran Elbursgebirge
Keredj [illegible]m. 6/5 1936
coll. Brandt

1296
NRM

Genitalia
Prep. No.
3754





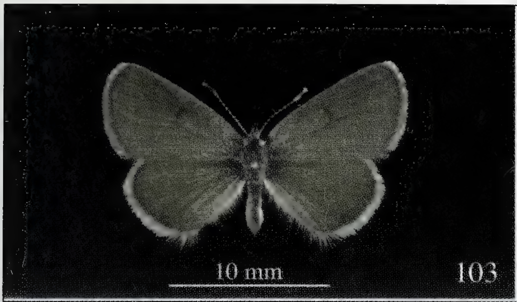
Figs. 98–102. *Turanana endymion ahasveros* (Bytinski-Salz & Brandt, 1937), lectotype ♂. **98.** Upperside. **99.** Underside. **100.** Data labels. **101.** Male genitalia, view on mesal wall of right valva. **102.** Male genitalia, view of distal end of mesal wall of right valva.

Turanana endymion ahasveros (Bytinski-Salz & Brandt, 1937)

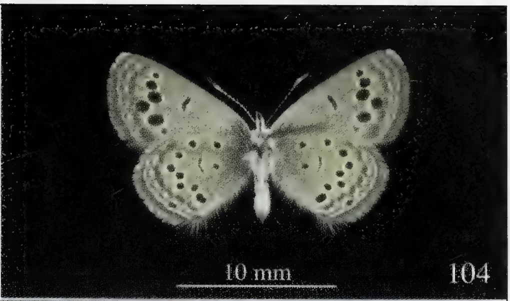
Lycaena (*Glaucopsyche*) *panagaea ahasveros* Bytinski-Salz & Brandt, 1937: (1). Type locality: Iran, Elburs Mts., Keredj (see Fig. 97 for original description).

Material. Lectotype ♂ designated here (Figs. 98–102), Iran, Elburs Mts., Keredj, 1700 m, 6.v.1936 (gen. prep. no. 3754), coll. NHRS. – Paralectotypes: 1♀ (Figs.103–105), same data; 4♂, same locality, 6.–10.v.1936, coll. NHRS; 5♂, 4♀, same locality, 6.–10.v.1936, coll. CMNH. – 1♂ **Iran**, Fars, road from Ardekan to Talochosroe, Comèe, ca. 3600 m, 4.vii. 1937, coll. NHRS; 1♂ Fars, road from Chiraz to Kazeroun, Fort Sine-Sefid, ca. 2200 m, 15.v.1937, coll. NHRS; 1♂ Elburs Mts., Keredj, 1700 m, 6.–10.v.1936, coll. NHRS; – *T. endymion ?-ahasveros*: 1♂ Iran, Mazanderan, Khosh-Yeylaq, 2000–2500 m, 15.–21.vii.1973, coll. De Prins, Olivier & v. d. Poorten.

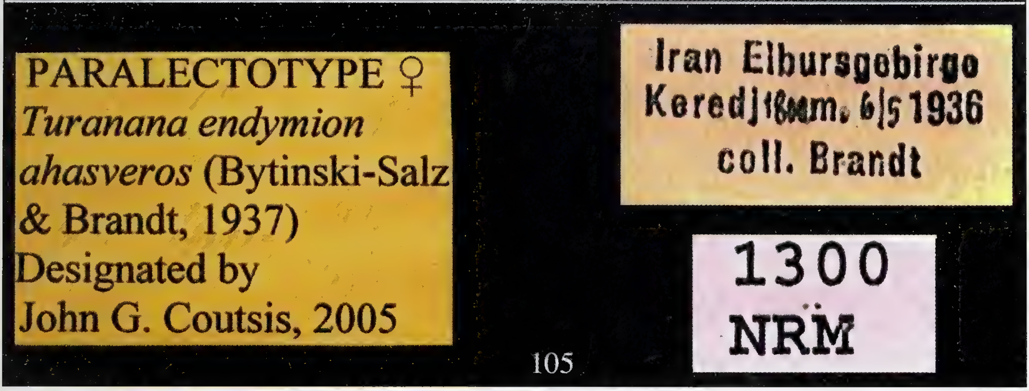
Description. Lectotype (Figs. 98, 99). Forewing length 11.7 mm. Upperside as in nominotypical *endymion*, but blue ground-colour of a "chalkier" lighter hue; blackish marginal borders averaging 2 mm in width, hindwing black spots within borders and



103



104


PARALECTOTYPE ♀
Turanana endymion
ahasveros (Bytinski-Salz
& Brandt, 1937)
Designated by
John G. Coutsis, 2005

Iran Elbursgebirge
Keredj 1800m. 6|5 1936
coll. Brandt

1300
NRM

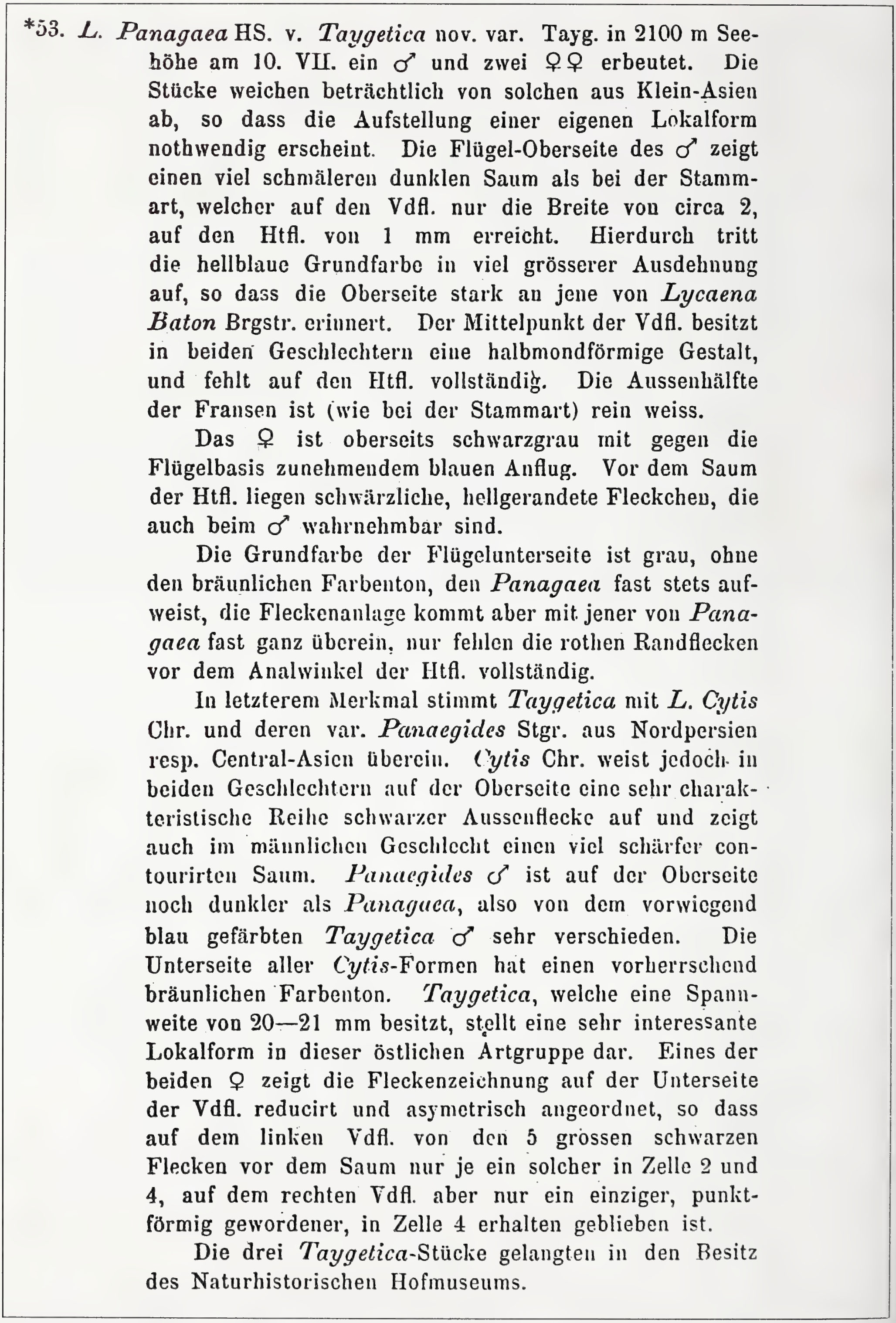
105

Figs. 103–105. *Turanana endymion ahasveros* (Bytinski-Salz & Brandt, 1937), paralectotype ♀. **103.** Upperside. **104.** Underside. **105.** Data labels.

forewing black stria in apex of cell better defined, and hindwing black stria in apex of cell present. Underside as in nominotypical *endymion*, but ground-colour slightly browner in tone and giving impression of having "clean and smooth" texture; double row of submarginal markings (with exception of one closest to wing margin in s2 of hindwing) lighter-coloured and not in sharp contrast to ground-colour; base of hindwing with better-defined shiny, whitish-blue dusting; usual orange scaling of hindwing substituted by light orange-beige and restricted macroscopically to s2; some light orange-beige dusting also evident microscopically in s1c and s3 of hindwing. Valva (Figs. 101, 102) 1.27 mm in length, with strongly extended apex, and possessing 12 terminal spikes, with most proximal shorter than next one and most distal situated at a distance from valval apex equal to a little under 1/3 total length of valval distal margin.

♀ paralectotype (Figs. 103, 104). Forewing length 9.7 mm. Upperside with ground-colour dark brown, wing outer-margins thinly lined black-brown, stria at apex of cell on forewing black-brown, fringes off-white on hindwing and off-white to light brown on forewing; base of wings with microscopically discernible light-blue dusting; traces of black-brown sub-marginal spots present on hindwing, especially in s2. Underside as in male, but fringes off-white to light-brown.

Variation. Expressed in males as in nominotypical *endymion*, but all specimens observed always with a well-defined black stria at the apex of the cell on the hindwing upperside, with the hindwing underside sub-marginal light orange-beige scaling



*53. *L. Panagaea* HS. v. *Taygetica* nov. var. Tayg. in 2100 m Seehöhe am 10. VII. ein ♂ und zwei ♀♀ erbeutet. Die Stücke weichen beträchtlich von solchen aus Klein-Asien ab, so dass die Aufstellung einer eigenen Lokalform nothwendig erscheint. Die Flügel-Oberseite des ♂ zeigt einen viel schmäleren dunklen Saum als bei der Stammart, welcher auf den Vdfl. nur die Breite von circa 2, auf den Htfl. von 1 mm erreicht. Hierdurch tritt die hellblaue Grundfarbe in viel grösserer Ausdehnung auf, so dass die Oberseite stark an jene von *Lycaena Baton* Brgstr. erinnert. Der Mittelpunkt der Vdfl. besitzt in beiden Geschlechtern eine halbmondförmige Gestalt, und fehlt auf den Htfl. vollständig. Die Aussenhälfte der Fransen ist (wie bei der Stammart) rein weiss.

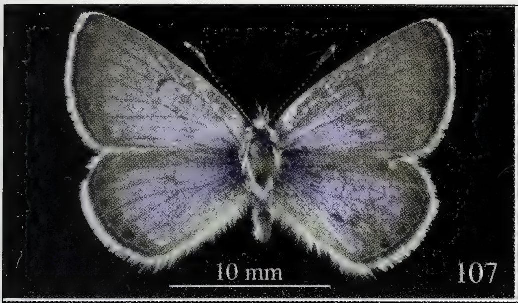
Das ♀ ist oberseits schwarzgrau mit gegen die Flügelbasis zunehmendem blauen Anflug. Vor dem Saum der Htfl. liegen schwärzliche, hellgerandete Fleckchen, die auch beim ♂ wahrnehmbar sind.

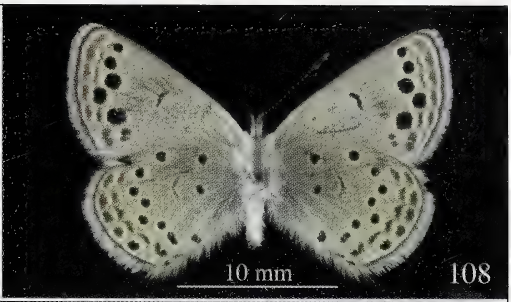
Die Grundfarbe der Flügelunterseite ist grau, ohne den bräunlichen Farbenton, den *Panagaea* fast stets aufweist, die Fleckenanlage kommt aber mit jener von *Panagaea* fast ganz überein, nur fehlen die rothen Randflecken vor dem Analwinkel der Htfl. vollständig.

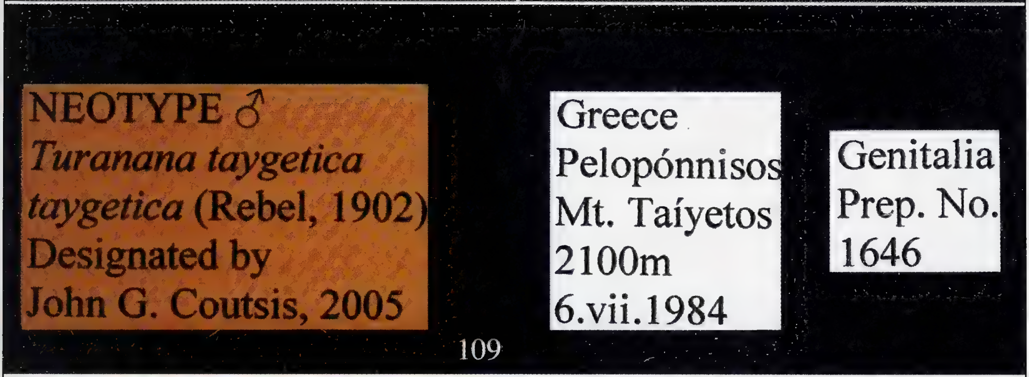
In letzterem Merkmal stimmt *Taygetica* mit *L. Cytis* Chr. und deren var. *Panaegides* Stgr. aus Nordpersien resp. Central-Asien überein. *Cytis* Chr. weist jedoch in beiden Geschlechtern auf der Oberseite eine sehr charakteristische Reihe schwarzer Aussenflecke auf und zeigt auch im männlichen Geschlecht einen viel schärfer contourirten Saum. *Panaegides* ♂ ist auf der Oberseite noch dunkler als *Panagaea*, also von dem vorwiegend blau gefärbten *Taygetica* ♂ sehr verschieden. Die Unterseite aller *Cytis*-Formen hat einen vorherrschend bräunlichen Farbenton. *Taygetica*, welche eine Spannweite von 20—21 mm besitzt, stellt eine sehr interessante Lokalform in dieser östlichen Artgruppe dar. Eines der beiden ♀ zeigt die Fleckenzeichnung auf der Unterseite der Vdfl. reducirt und asymetrisch angeordnet, so dass auf dem linken Vdfl. von den 5 grossen schwarzen Flecken vor dem Saum nur je ein solcher in Zelle 2 und 4, auf dem rechten Vdfl. aber nur ein einziger, punktförmig gewordener, in Zelle 4 erhalten geblieben ist.

Die drei *Taygetica*-Stücke gelangten in den Besitz des Naturhistorischen Hofmuseums.

Figs. 106. Original description of "*L*[*ycaena*]. *Panagaea* HS. V. *Taygetica* nov. var." by Rebel, 1902: 90–91.

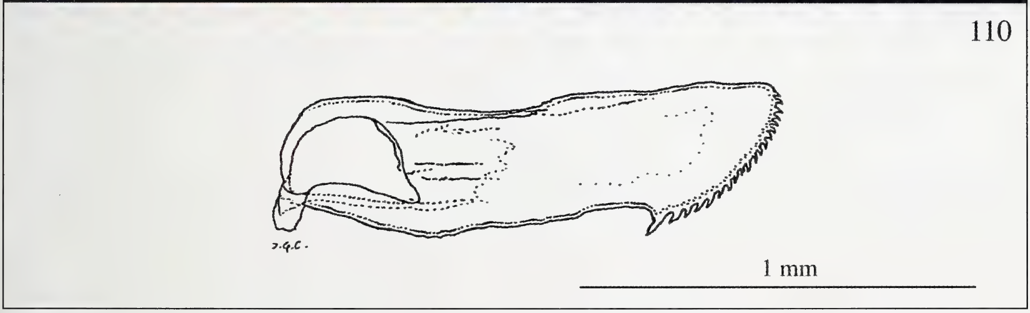





NEOTYPE ♂
Turanana taygetica
taygetica (Rebel, 1902)
Designated by
John G. Coutsis, 2005

Greece
Pelopónnisos
Mt. Taíyetos
2100m
6.vii.1984

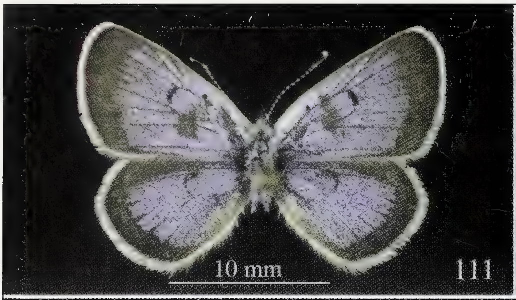
Genitalia
Prep. No.
1646



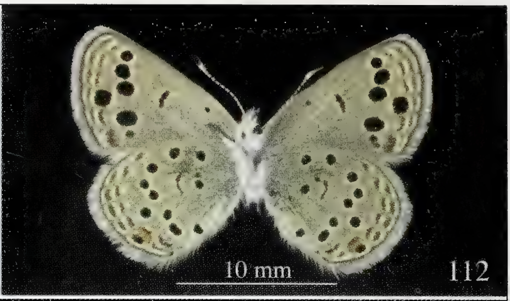
Figs. 107–110. *Turanana taygetica taygetica* (Rebel, 1902) stat. n., neotype ♂. **107.** Upperside. **108.** Underside. (Antennae inadvertently broken off during photographing; one antenna later restored). **109.** Data labels. **110.** Male genitalia, view on mesal wall of right valva.

restricted to s1c and s2 and never extending beyond s3, and with more evident basal, shiny, whitish-blue dusting on the hindwing underside. The variation in the females cannot be defined, due to lack of material.

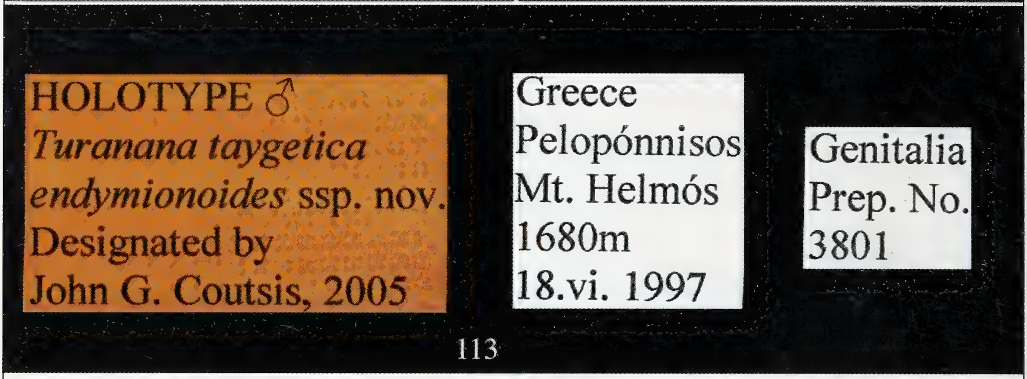
Male genitalia. Recent material obtained for study and representing the syntypes of *ahasveros*, as well as coming from places in Iran situated outside the type-locality of *ahasveros*, though following the nominotypical *endymion* general valval pattern, demonstrate a strong extension of the valval terminal apex (Figs. 35–37). Valvae with the above-described configuration are also illustrated in Tshikolovets (1998), from Turkmenistan, in Tuzov et al. (2000), from the Armenian highland, and in Zhdanko (1984), without locality data. Two specimens of *T. endymion* ?-*ahasveros* – one of which is shown on Fig. 38 – from Mazanderan, Iran, are externally attributable to *ahasveros*, but were found to have valvae that are identical to those of nominotypical *endymion*.



111



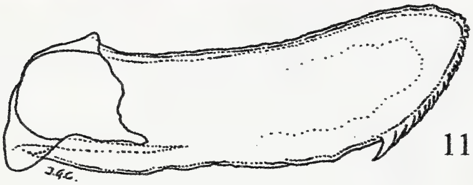
112


HOLOTYPE ♂
Turanana taygetica
endymionoides ssp. nov.
Designated by
John G. Coutsis, 2005

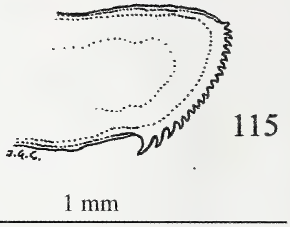
Greece
Pelopónnisos
Mt. Helmós
1680m
18.vi. 1997

Genitalia
Prep. No.
3801

113



114



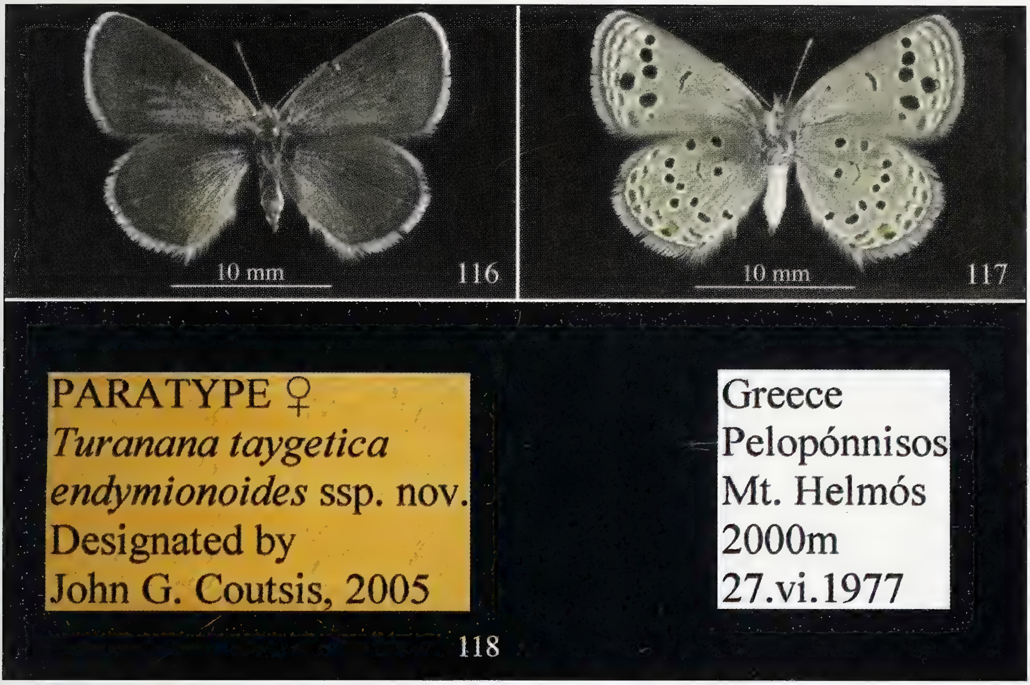
115

Figs. 111–115. *Turanana taygetica endymionoides* ssp. n., holotype ♂. **111.** Upperside. **112.** Underside. **113.** Data labels. **114.** Male genitalia, view on mesal wall of right valva. **115.** Male genitalia, view on distal end of mesal wall of right valva.

Distribution. *Turanana endymion ahasveros* (Bytinski-Salz & Brandt, 1937) applies to specimens from the Elburs range in Iran and from mountains in the province of Fars that possess valvae that are similar to those of *topotypical ahasveros*. *Turanana endymion* ?-*ahasveros* applies to specimens from mountains in the province of Mazanderan, Iran, whose valvae are found to be similar to those of nominotypical *endymion*.

Turanana taygetica taygetica (Rebel, 1902) stat. n.

L[*ycaena*] *Panagaea* v. *Taygetica* Rebel, 1902: 90–91. Type locality: Greece, Morea (= Pelopónnisos), Taygetos Gebirge (= Mt. Taíyetos). (see Fig. 106 for original description). Syntypes (1♂, 2♀) presumably lost.



PARATYPE ♀
Turanana taygetica
endymionoides ssp. nov.
Designated by
John G. Coutsis, 2005

Greece
Pelopónnisos
Mt. Helmós
2000m
27.vi.1977

Figs. 116–118. *Turanana taygetica endymionoides* ssp. n., paratype ♀. **116.** Upperside. **117.** Underside. **118.** Data labels.

Material. Neotype ♂, designated here (Figs. 107–110), **Greece**, Pelopónnisos, Mt. Taíyetos, 2000 m, 6.vii.1984 (gen. prep. no. 1646), Coutsis leg., coll. ZMAN. – 1♂ Greece, Pelopónnisos, Mt. Taíyetos, 1150–1200 m, 16.vi.2003, Coutsis leg., coll. Coutsis.

Description. Neotype (Figs. 107, 108). Forewing length 12.5 mm. Upperside as in nominotypical *endymion*, but blue ground-colour slightly lighter than in nominotypical *endymion* and slightly darker and brighter than in ssp. *ahasveros*; blackish marginal borders averaging about 1.3 mm in width and having a poorly defined inner margin, especially on hindwing; black spots contained inside blackish borders standing out rather sharply; black stria at apex of cell evident on forewing, but imperceptible on hindwing. Underside as in nominotypical *endymion*, but ground-colour whitish-gray, post-discal black spots placed closer to wing outer-margins, and usual hindwing submarginal orange spots substituted by single macroscopically-evident yellowish-beige spot in s2 only; yellowish-beige dusting also evident microscopically on hindwing in s1c and s3; base of hindwing with faint, shiny, whitish-blue dusting. Valva (Fig. 110) 1.59 mm in length; terminal spikes 20 in number and extending along whole length of valval distal margin, reaching its apex; most proximal spike decidedly longest.

Variation. This is expressed in the males by their overall size (forewing length from just under 10 mm to about 12.5 mm), by the extent, width and definition of the blackish marginal borders on the upperside (in some specimens these are being clearly invaded by blue scaling especially on the hindwing), by the number and definition of

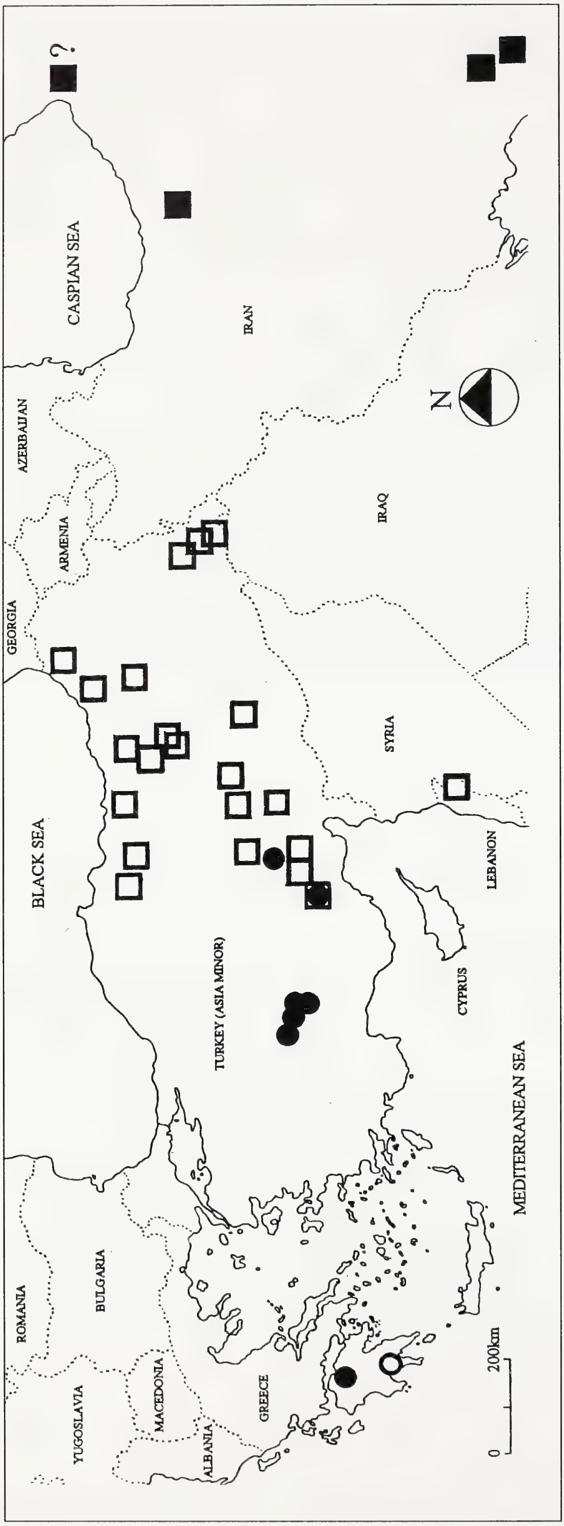


Fig. 119. Map indicating sampling localities of *Turanana endymion* and *T. taygetica*.

□ = *T. endymion endymion*
■ = *T. endymion ahasveros*
○ = *T. taygetica taygetica*
● = *T. taygetica endymionoides*

black spots within these borders on the hindwing upperside, and by the occasional presence of blue rings surrounding the black spots located within the blackish marginal borders. On the underside there is some variation in the extent and definition of the sub-marginal yellow-beige dusting on the hindwing, which occasionally may also be seen microscopically in s1b and s4. The single dark brown female at hand has a forewing length 12.5 mm and is characterised on the upperside by the extended basal blue dusting, by the presence of a narrow sub-marginal light brown area – in the form of a poorly defined band – enclosing black-brown spots (most evident on hindwing in s2 through s5), by a well-defined black-brown stria at the apex of the cell, and by the presence of weekly-defined black-brown post-discal spots on the forewing. Underside, as in males, but the variation is unknown, due to lack of material.

Male genitalia. Right and left valvae roughly symmetrical to one another, as in nominotypical *endymion*, but longer than those of nominotypical *endymion* for specimens of equal, or near equal forewing length (these conditions are figured below under *T. taygetica endymionoides*, which has similar male genitalia to nominotypical *taygetica*) The degree of variation in the number of terminal spikes cannot at present be calculated due to lack of sufficient material. The three characters, however, that stand out as being constant are the long valva, the fact that the most proximal terminal spike (occasionally also bearing a single, or bifid minute extension just basad to it) is always decidedly the longest of the lot, and that the terminal spikes extend all along the distal margin of the valva, clearly reaching its apex.

Distribution. *Turanana taygetica taygetica* (Rebel, 1902) stat. n. applies to specimens derived from the type locality only.

Life history. A low-flying species with males often found watering at altitudes of as low as 1100–1200 m, inside the forest zone and outside the vicinity of *Acantholimon* bushes, the presumed host-plant.

Turanana taygetica endymionoides ssp. n.

Material. Holotype ♂ (Figs. 111–115), **Greece**, Pelopónnisos, Mt. Helmós, 2000 m, 27.vi.1977 (gen. prep. no. 3801), Coutsis leg. coll. ZMAN. – Paratypes (all with same locality data): 1♀ (Figs. 116–118), 2000 m, 27.vi.1977, Coutsis leg., coll. ZMAN; 7♂, 2♀, 1800–1900 m, 4.vi.1997; 3♂, 1♀, 1800 m, 20.vi.1998; 1♂, 2100 m, 23.vi.1981; 1♂, 1700–1800 m, 12.vi.2001; 1♀, 2000 m, 27.vi.1977; 1♀, 2100 m, 23.vi.1981; 1♀, 1650 m, 18.vi.1997, all Coutsis leg. et coll. – 2♂ Greece, Pelopónnisos, Mt. Helmós, 1800 m, 12.vi.2001, leg. et coll. Coutsis; 4♂ **Turkey**, Afyon province, Sultandağları, 10 km S of Çay, 1300 m, 18.–25.vii.1980, coll. De Prins, Olivier & v. d. Poorten; 1♂ Afyon province, Sultandağları, 15 km SE of Çay, 1400–1800 m, 14–18.vii.1981, coll. De Prins, Olivier & v. d. Poorten; 3♂ Afyon province, Sultandağları, 8 km SW of Dereçine, 1700–2200 m, 19.–20.vii.1981, coll. De Prins, Olivier & v. d. Poorten; 1♂ Karaman province, Sertavul Geçidi, 1500 m, 1.viii.1995, coll. De Prins, Olivier & v. d. Poorten; 1♂ Kayseri province, Aladağları E side, 2800–2900 m, 18 km S of Yahyalı, 26.vii.–2.viii.1995, coll. De Prins, Olivier & v. d. Poorten; 1♂ Konya province, Sultandağları, 15 km S of Akşehir, 1500 m, 16.–19.vii.1981, coll. De Prins, Olivier & v. d. Poorten; 12♂ Konya province, Sultandağları, 15 km S of Akşehir, 1500 m, 12.–21.vii.1981, coll. De Prins, Olivier & v. d. Poorten; 1♂ Konya province, Sultandağları, 6km S of Çankaturan, 23km SSE of Akşehir, 1700 m, 12.–21.vii.1995, coll. De Prins, Olivier & v. d. Poorten; 3♂ Konya province, Sultandağları, Akşehir, 1100 m, 17.–26.vii.1980, coll. De Prins, Olivier & v. d. Poorten; 2♂ Konya province, Sultandağları, 22 km SE of Akşehir, 1600–1900 m, 29.vii.1995, coll. De Prins, Olivier & v. d. Poorten; 1♂ Konya province, 12 km SW of Engilli, 1300–1600 m, 12.vii.1981, coll. De Prins, Olivier & v. d. Poorten; 1♂ Konya province, 10 km NE of Gelendost, 1000 m, 16.vii.1980, coll. De Prins, Olivier & v. d. Poorten; 1♂ Konya province, Derebucak, 1100 m, 11.vii.1981, coll. De Prins, Olivier & v. d. Poorten; 1♂ Konya province, Akşehir, 1900 m, coll. De Prins, Olivier & v. d. Poorten; 1♂ Niğde province, Aladağları E side, 10 km S of Yahyalı, 1800–1900 m, 26.vii–2.viii.1994, coll. De Prins, Olivier & v. d. Poorten; 1♂ Niğde province, Bolkardağları N side, near Maden, 1500–1650 m, 18.vii.1995, coll. De Prins, Olivier & v. d. Poorten.

Description. Holotype (Figs. 111, 112). Forewing length 12.0 mm. Upperside ground-colour slightly lighter and shinier blue than in nominotypical *endymion* (due to the relative freshness of the specimen; specimens that have been kept longer in collections have the same ground-colour as do nominotypical *endymion* of same age); blackish marginal borders averaging 1.5 mm in width and with sharply defined proximal edge; black spots evident within these borders on hindwing in s2 through s6; black stria of apex of cell well-defined on both forewing and hindwing, but half as wide on the hindwing than on the forewing; fringe pure white. Underside ground-colour, fringes, and spot arrangement as in nominotypical *endymion*, but sub-marginal orange scaling on hindwing fully developed in s2 only, macroscopically appearing as narrow dusting in s1c and s3 and microscopically also in s4; base of hindwing with faint, shiny, whitish-blue dusting. Valva (Figs. 114, 115) 1.48 mm in length and bearing 20 terminal spikes in same arrangement as in nominotypical *taygetica*.
♀ paratype (Figs. 116, 117). Forewing length 11.9 mm. Upperside ground-colour dark brown, as in nominotypical *endymion*; base of wings with blue scaling extending on forewing into post-discal area; outer margins of wings thinly lined black-brown; sub-marginal black-brown spots present on both forewing and hindwing; black-brown stria at apex of cell clearly evident on forewing, less so on hindwing; some post-discal black-brown spots also in evidence on forewing; fringes white. Underside as in male, but fringes off-white.
Variation. This is expressed in both males and females by their overall size (forewing length from a little under 10 mm to about 12 mm), and on the upperside of the males in particular by the width and definition of the blackish marginal border, the extent of black spotting and occasional blue dusting within this border, the degree of definition of the black stria at the apex of the cell on the hindwing, and the extension of the blackish marginal border into the post-discal area of forewing, just basad of its apex. On the underside it is expressed primarily by the extent of sub-marginal orange scaling and of the basal, shiny, whitish-blue dusting on the hindwing. In the females variation is expressed on the upperside by the amount of basal blue scaling, by the degree of definition and number of black-brown sub-marginal and post-discal spots, and by the occasional presence of a light brown sub-marginal area on the hindwing. Underside variation as in male.
Male genitalia. Identical to those of nominotypical *taygetica*; right and left valvae (Fig. 6) roughly symmetrical to one another, as in nominotypical *endymion* (Fig. 5), but longer (Fig. 3) than those of nominotypical *endymion* (Fig. 1) for specimens of equal, or near equal forewing length. Number of terminal spikes very variable (12–25). In specimens from a single locality the number of spikes was found to vary from 14–23 (Figs. 66–87).
Distribution. *Turanana taygetica endymionoides* ssp. n. applies to specimens that have the same valvae as those of nominotypical *taygetica*, but differ externally from it, and that are found in Greece on Mt. Helmós only (where it was first recorded by Thurner 1967, who listed it as *Vaccinii*[*n*]*a panagaea taygetica* Rebel) and in the western half of Asiatic Turkey (specimens figured in Hesselbarth et al. 1995, pl. 97 figs. 52, 56, 58, 59, 63, 65, 70, are within all probability referable to *taygetica*, as all material checked from the Turkish provinces of Konya and Afyon invariably turned out to be *taygetica*). Syntopic and synchronous with *endymion* in south-central Asiatic Turkey.

Life history. Tolman (1993) discovered on Mt. Helmós the larvae feeding on *Acantholimon androsaceum* ([Jaub & Spach]. Bois, 1846) (Plumbaginaceae). The adults are low-flying and restricted to within the vicinity of the host-plant; found above the tree line and at altitudes ranging from about 1800–2000 m. So far never seen watering despite the fact that a water spring is situated at about 250 m away from its host-plants.

Derivatio nominis. The name *endymionoides*, meaning in Greek "looking like *endymion*", was chosen because of the butterfly's greater external resemblance to nominotypical *endymion* than to nominotypical *taygetica*.

External differentiation

Male specimens of nominotypical *endymion* may be told apart from ssp. *ahasveros* by the darker blue and somewhat shinier ground-colour of the wings upperside and by the – on average – wider marginal blackish borders. On the underside they differ from *ahasveros* by the greyer, less brown and "rough-looking" ground colour, by the better-defined sub-marginal double row of black-brown spots, and by the greater spreading and more intense colour of the sub-marginal orange scaling on the hindwing. Female nominotypical *endymion* differ from those of *ahasveros* on the underside as do the males.

Both male and female *ahasveros* differ from all other members of the species-group on the underside by the brownish tinge and "smooth" texture of the ground-colour, by the less contrasting sub-marginal double row of black-brown markings, and by the light orange-beige colour of the hindwing sub-marginal dusting. Males on the upperside differ by their "chalkier" and lighter blue ground-colour.

Male specimens of nominotypical *taygetica* differ from all other members of the species-group on the upperside by the narrower and poorly defined blackish marginal borders and on the underside by the light grey ground-colour, by the position of the post-discal black spots, these being closer to the wing outer margins, and by the substitution of the usual sub-marginal orange dusting on the hindwing by one of yellow-beige tint; they differ from the males of *endymionoides* on the upperside by the slightly lighter blue ground-colour. The single available female specimen of the nominotypical *taygetica* differs on the underside from all other members of the species-group as do the males.

Male specimens of topotypical ssp. *endymionoides* as a rule differ from all other members of the species-group on the upperside by the sharper blackish marginal borders, and from nominotypical *endymion* in particular, on the upperside by the narrower blackish marginal borders, and on the underside by the more restricted spread of the hindwing sub-marginal orange scaling. Female *edymionoides* differ on the underside from nominotypical *endymion* as do the males and from nominotypical *taygetica* by the darker, grey-brown (instead of light grey) ground-colour and the orange (instead of yellow-beige) sub-marginal hindwing dusting.

Specimens of *endymionoides* from Asiatic Turkey cannot be told apart from nominotypical *endymion* (at least macroscopically and on the basis of the rather limited available material), and they differ from topotypical *endymionoides* in the same way as does nominotypical *endymion* differ from topotypical *endymionoides*. As previously said, however, I have tentatively included them under ssp. *endymionoides* because of occasional character overlap with topotypical *endymionoides* and because of the unavailability of geographically intermediate material from the western extremity of Asiatic Turkey, that might conceivably reveal the existence of a cline in external characters.

The need for further validation

The taxonomic arrangements that have now been adopted for the *endymion* species-group, should eventually be further validated – or perhaps even disputed – by a future study of the DNA-sequences of the various taxa in this species-group. It is hoped that this task will not take long to materialize.

Acknowledgements

I would like to extend my sincerest thanks and express my gratitude to all those people whose assistance made it possible for me to carry out this endeavour. I am particularly indebted to Bert Gustafsson of the Naturhistoriska Riksmuseet, Stockholm, Sweden, for providing me with the syntypes of *ahasveros*; to Willy De Prins, Alain Olivier and Dirk van der Poorten, from Antwerpen, Belgium for providing me with a good many of the Asiatic Turkey specimens used in dissections; to Martin Lödl and Sabine Gaal-Haszler of the Naturhistorischen Hofmuseum, Wien, Austria, for patiently assisting me in my vain endeavour to trace down the *taygetica* syntypes; to Harry van Oorschot of the Zoölogisch Museum, Amsterdam, Netherlands, for providing me with material from Turkey that included specimens derived from the type locality of *endymion*; and last but not least to Konrad Fiedler, Matthias Nuss, Martin Wiemers, all from Germany, for their invaluable advice and much-needed criticism.

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A review of the genus *Metanarsia* Staudinger, 1871 (Gelechiidae)

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Abstract. All known species of the Palaearctic genus *Metanarsia* Staudinger, 1871 are reviewed. Ten species are recognized, of which two are described as new: *M. piskunovi* **sp. n.** and *M. dahurica* **sp. n.** Four synonymies are established: *Parametanarsia* Gerasimov, 1930 **syn. n.** and *Epiparasia* Rebel, 1914 **syn. rev.** are synonymised with *Metanarsia* Staudinger, 1871; *Metanarsia gobica* Lvovsky & Piskunov, 1989 **syn. n.** with *M. alphitodes* (Meyrick, 1891), and *Epidola halmyropis* Meyrick, 1926 **syn. n.** with *M. incertella* (Herrich-Schäffer, 1861). Descriptions and a key to all species are supplied with illustrations of the adults, male and female genitalia (when known), and their relationships within the genus are briefly discussed. An improved diagnosis of the genus is given and its relationships with allied gelechiid genera are discussed.

Key words. Lepidoptera, Gelechiidae, *Metanarsia*, taxonomic review, Palaearctic region.

Introduction

The genus *Metanarsia* comprises ten species which all occur in the Palaearctic region. The most valuable contributions to the systematics of this genus were made by Piskunov and co-authors (Emelyanov & Piskunov 1982; Piskunov 1988, 1990; Lvovsky & Piskunov 1989). These authors refined the definition of the genus, reviewed all species, illustrated their male genitalia, and described new taxa. More recently, the identity of *Metanarsia* and *Epiparasia* Rebel, 1914 was discussed, further new species were described, and new generic- and species-group name synonymies proposed (Huemer et al. 1996; Ponomarenko 2000).

Notwithstanding a relatively large number of publications, our knowledge of *Metanarsia* is in many respects far from complete. For example, the larval host-plant relationships are unknown. Also, the females of many species remain undescribed, which leads to problems in establishing a clear generic diagnosis and in the generic assignment of some species.

In the course of my studies, two undescribed species and two hitherto unknown females were discovered as well as a first host-plant record for *Metanarsia*. These new data encouraged me to carry out a review of the genus with the aim to describe the new taxa and to provide detailed descriptions and a key for all species, accompanied by illustrations of the adults and genitalia of both sexes (when known). This review is also intended to provide an improved diagnosis of the genus *Metanarsia* based on morphological characters of the adults.

Abbreviations

BMNH	The Natural History Museum, London, U. K.
DEI	Deutsches Entomologisches Institut, Müncheberg, Germany
MHNG	Muséum d'histoire naturelle, Geneva, Switzerland
MTD	Museum für Tierkunde, Dresden, Germany

SIZK	Schmalhausen Institute of Zoology, Ukrainian Academy of Sciences, Kiev, Ukraine
TLMF	Tiroler Landesmuseum Ferdinandeum, Innsbruck, Austria
ZIN	Zoological Institute, Russian Academy of Sciences, St. Petersburg, Russia
ZMHB	Zoologisches Museum der Humboldt-Universität, Berlin, Germany
ZMKU	Zoological Museum, Kiev National Taras Shevchenko University, Kiev, Ukraine
ZMUC	Zoological Museum, University of Copenhagen, Denmark
ZMUH	Zoological Museum, University of Helsinki, Finland

Metanarsia Staudinger, 1871

Metanarsia Staudinger, 1871: 314. Type-species: *Metanarsia modesta* Staudinger, 1871: 314, by monotypy.

Calyptrotis Meyrick, 1891: 56. Type-species: *Calyptrotis alphitodes* Meyrick, 1891: 56, by monotypy. Synonymized by Ponomarenko 2000: 222.

Epiparasia Rebel, 1914: 276. Type-species: *Epiparasia longivitella* Rebel, 1914: 276, pl. 4 fig. 12, by monotypy. **Syn. rev.** Piskunov 1990: 95 (syn.). Huemer et al. 1996: 341 (gen.).

Parametanarsia Gerasimov, 1930: 33 (as subgenus of *Metanarsia*). Type-species: *Metanarsia (Parametanarsia) junctivittella* Christoph, 1885: 161, pl. 8 fig. 11, by original designation and monotypy. **Syn. n.**

Diagnosis. Adults small to medium sized with forewing length of 5.0–13.0 mm.

Head smooth-scaled. Labial palpus variable in shape: segments 2 and 3 usually straight, but recurved in *M. incertella* (Herrich-Schäffer, 1861) and *M. alphitodes* (Meyrick, 1891); segment 2 broad, densely covered with long scales usually exceeding length and width of segment 3; segment 3 normally very short, covered partially or almost entirely with long scales of segment 2. Scape with pecten of numerous long hair-like scales or with dense brush of short scales (*M. partilella* (Christoph, 1887)), other antennal segments simple. Haustellum reduced or very short, covered by labial palpus, but sometimes well developed (*M. alphitodes*, *M. piskunovi* sp. n.).

Thorax. Forewing usually relatively broad or elongated (*M. junctivittella*), sometimes slightly concave before apex (*M. partilella*), but mostly gradually tapered towards apex; unicolorous greyish-cream, reddish-brown, yellow, etc., or with more or less developed fasciae or longitudinal patches and spots; fringe very long; venation (Fig. 1) with Sc to about middle of costa; R_1 from one-third of cell, R_2 from three-quarters of cell, R_3 and R_4 from corner of cell, R_4 and R_5 on common stalk or R_4 reduced whereas R_3 and R_5 arise from corner of cell (*M. junctivittella*), R_5 to costa before apex; cell narrow; CuP absent; 1A+2A forked at base. Hindwing grey, normally with distinctly excavated termen; venation with R_1 anastamosed with M_1 near base, Rs and M_1 with long common stalk, R_5 to costa near apex, M_1–M_3 to termen, M_3 free, not connate CuA_1, 1A–2A indistinct. Frenulum of male simple, retinaculum a membranous hook under Sc near base. Frenulum of female consisting mainly of two acanthae which may be fused (*M. dahurica* sp. n., *M. junctivittella*), divided only at base (*M. modesta*), or completely separated (*M. alphitodes*, *M. piskunovi* sp. n.); frenulum of *M. incertella* with three fused acanthae, and that of *M. partilella* consisting of four to five acanthae slightly divided at base. Retinaculum a row of raised scales at base of Sc and along R. Foretibia with epiphysis, midtibia with two spurs, and hindtibia with four spurs.

Abdomen. Sternite VIII normally weakly sclerotized, usually as long as wide or longer than wide (Fig. 28), but in *M. partilella* more than three times wider than long. Female segment VII about twice length of other abdominal segments, weakly narrowed posteriorly. Sternite II of both sexes with pair of venulae with distinct apodemes (Fig. 29).

Male genitalia. Uncus broad, lateral margins usually densely covered with hair-like setae, apex sometimes with deep medial depression. Gnathos weakly sclerotized, membranous, flattened dorsoventrally, usually long and slender, often spoon-like distally, weakly curved; sometimes broad, sucker-like (*M. partilella*), or reduced and indistinct (*M. alphitodes*). Tegumen broad and short, trapezoid. Valva divided at base into cucullus and sacculus. Cucullus slender, slightly longer or as long as uncus, finger-like, often narrowed at base, apex weakly broadened and rounded, densely covered with short setae. Sacculus normally broad, distinctly shorter than cucullus, with one lateral and three or four apical teeth, sometimes covered with short dense setae (*M. alphitodes*) or simple, slender, without modifications (*M. partilella*); inner margin of sacculus with emargination near base. Valvae connected at base by well developed broad medial processes. Vinculum narrow, band-like, posterior margin with paired sub-oval lobes or with narrow triangular processes with delicate membranous connection to apex of aedeagus. Saccus short, broadly rounded, triangular or sub-rectangular (*M. partilella*). Aedeagus normally short, about as long as sacculus, usually bifurcated at base, apex rounded with one or two (*M. junctivittella*) small teeth on one side whereas opposite side is membranous; aedeagus of *M. partilella* very long, not bifurcated basally.

Female genitalia. Papillae anales broad, apically narrowed, sub-triangular, sparsely covered with short setae, except those of *M. partilella* densely covered with very long, hair-like setae. Apophyses posteriores relatively short, slightly curved; apophyses anteriores about three-quarters length of apophyses posteriores, shorter than segment VIII. Segment VIII mainly membranous, sclerotized only laterally and anteriorly, its anterior margin narrow, band-shaped. Ostium bursae on ventral membranous surface of sternite VIII. Ductus bursae short, membranous, evenly broadened towards corpus bursae. Corpus bursae very long, semioval, indistinctly separated from ductus bursae. Ductus and corpus bursae of *M. partilella* extremely short. Signum absent.

Relationships. *Metanarsia* is considered a member of Gelechiinae on the basis of the presence of a pair of venulae, terminating in distinct apodemes on abdominal sternum II. Within Gelechiinae *Metanarsia* resembles *Chrysoesthia* Hübner, 1825 in the male genitalia (shape of aedeagus, shape of valva, membranous gnathos), and *Chrysoesthia* and *Coloptilia* Fletcher, 1940 in the female genitalia (segment VIII sclerotized anterolaterally, papilla anales sub-triangular). *Metanarsia* differs reliably from the above genera in the absence of a signum on the bursae in the female genitalia. These three genera are traditionally considered members of Apatetrini–Anomologini (Karsholt & Riedl 1996: 104), although the classification of these two tribes needs special revision.

Metanarsia is a diverse gelechiid genus for which the external and genital characters vary extensively. The monophyly of *Metanarsia* is not very clear and was previously established by such presumed autapomorphies as a very short ductus bursae in combination with an extremely long corpus bursae without signum. Other diagnostic characters of *Metanarsia* are present in related genera also (see above). The most isolated position within the genus is occupied by *M. partilella* which is characterized by a dense brush of short scales on the scape, a sucker-like gnathos, hairy papillae anales, and an extremely short ductus and corpus bursae in the female genitalia. The male genitalia of this species are characterized by a unique valva which is not entirely divided into a cucullus and sacculus, as well as by a long and basally simple (not bifurcated) aedeagus. *M. incertella* is another species for which the assignment to *Metanarsia* is disputable. Piskunov (1990: 95) synonymized *Epiparasia* with *Metanarsia*, but his opinion was not accepted by subsequent authors (Huemer et al. 1996: 341), who considered *Epiparasia* as a separate genus on the basis of the strongly recurved labial palpus and the clearly separated ductus bursae in the female genitalia. Ponomarenko (2000: 222) followed Piskunov's view and treated *Epiparasia* as a junior synonym of *Metanarsia* mentioning that the shape of the labial palpus is quite variable within the genus. Gerasimov (1930: 33) established the new subgenus *Parametanarsia* for *M. junctivittella* on the basis of the female frenulum which is represented by fused acanthae, in contrast to those of *M. modesta* which are basally separated. It was also mentioned that *Parametanarsia* is characterized by the elongated forewing and its special venation (R_3 and R_5 from end of cell, R_4 reduced). As follows from a review of the external and genital characters of *Metanarsia* the female frenulum, wing venation, and shape of labial palpus are quite variable within the genus and probably reflect individual adaptations of species. So using such characters for establishing new taxa seems to me quite dubious and I treat *Parametanarsia* **syn. n.** and *Epiparasia* **syn. rev.** as junior subjective synonyms of *Metanarsia* Staudinger, 1871. All other *Metanarsia* species are homogeneous both in exterior and in genital characters, except for *M. alphitodes*, which is characterized by its setose apex of the sacculus.

In general the establishment of new taxa of the genus group within such a small genus as *Metanarsia* for some species (*M. incertella* or *M. partilella)* which differ only in some characters seems to be inappropriate at least at the present stage, while a global revision of Apatetrini–Anomologini is still in need. For preliminary definitions of relationships within the genus the most sensible solution seems to call for the grouping of the species in the following species groups:

***Metanarsia modesta*-group**
modesta Staudinger, 1871
    modesta kurdistanella Amsel, 1959
onzella Christoph, 1887
kosakewitshi Piskunov, 1990
dahurica **sp. n.**
scythiella Ponomarenko, 2000
piskunovi **sp. n.**
***Metanarsia junctivittella*-group**
junctivittella Christoph, 1885

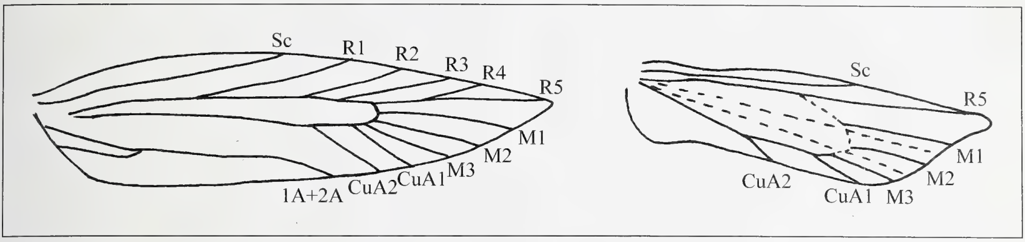


Fig. 1. *Metanarsia modesta*, ♂, wing venation.

***Metanarsia alphitodes*-group**
alphitodes (Meyrick, 1891)
  gobica Lvovsky & Piskunov, 1989, **syn. n.**
***Metanarsia incertella*-group**
incertella (Herrich-Schäffer, 1861)
  longivitella Rebel, 1914
  halmyropis Meyrick, 1926, **syn. n.**
***Metanarsia partilella*-group**
partilella (Christoph, 1887)

Life history. *Nitraria* sp. (Nitrariaceae) was recorded as a host plant for *M. alphitodes,* but the host plant relationships of other species of *Metanarsia* remain unknown. Adults fly from April to September and most species are probably univoltine. Many species are nocturnal and easily attracted to light.

Distribution. The majority of the species inhabit steppes, deserts, and semideserts of the Palaearctic region. The largest number of species occurs in the arid regions of Central Asia. Most of the species are considered localised (*M. scythiella, M. kosakewitshi, M. piskunovi* sp. n.), whereas such species as *M. modesta, M. alphitodes*, and *M. incertella* are widely distributed.

Key to the species of *Metanarsia* based on external characters

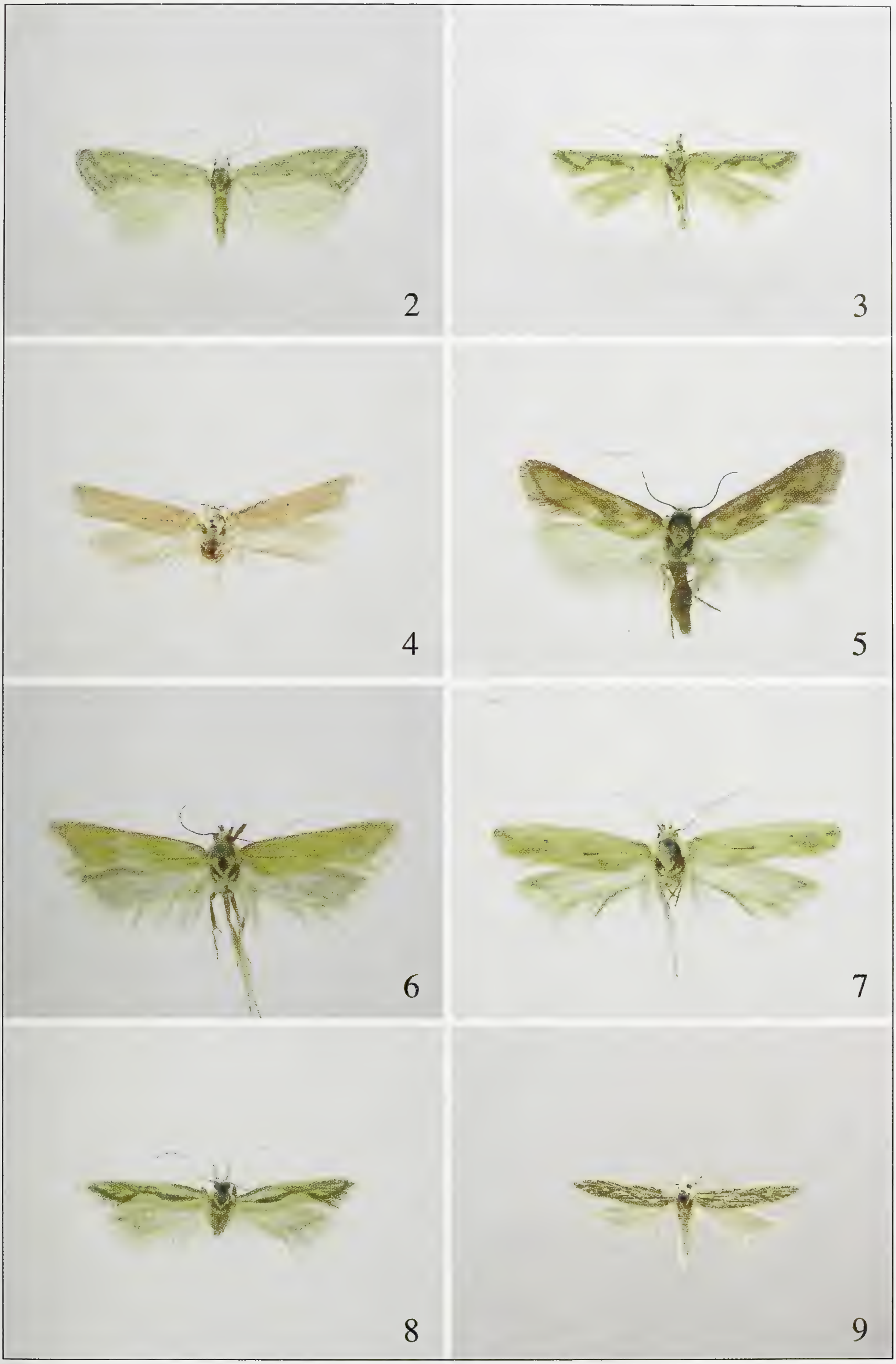
1. Labial palpus recurved, segment 2 slender 2
– Labial palpus straight, segment 2 broad 3
2. Labial palpus long, strongly curved; forewing uniformly yellowish-cream or with brown longitudinal lines; haustellum reduced; forewing length 8.0–13.0 mm .... *M. incertella*
– Labial palpus slightly recurved; forewing with brown transversal fascia; haustellum well developed; forewing length 5.0–7.0 mm .... *M. alphitodes*
3. Labial palpus very long, straight, segment 2 covered with very long setae; forewing dark yellow with brown longitudinal line or uniformly yellowish-cream .... *M. junctivittella*
– Labial palpus short, segment 2 covered with relatively short setae 4
4. Forewing primarily yellow, without lines 5
– Forewing cream, grey, or reddish-brown 6

5. Forewing bright yellow, with reddish-pink costal margin, without spots; haustellum reduced; forewing length 11.5 mm .... *M. scythiella*
– Forewing uniformly yellowish-cream, pale, with two small brown spot in middle and at two-thirds length; haustellum well developed; forewing length 10.0–11.0 mm .... *M. piskunovi* sp. n.
6. Forewing reddish-brown 7
– Forewing grey or cream 8
7. Forewing uniformly reddish-brown .... *M. kosakewitshi*
– Forewing reddish-brown, more contrasting, with distinct brown oblique transversal fascia from one-third of posterior margin to half width .... *M. dahurica* sp. n.
8. Forewing primarily grey without yellow patches 9
– Forewing cream with yellow patches and diffuse yellowish-brown spots .... *M. onzella*
9. Forewing whitish-grey, without white fasciae; forewing length 6.0–10.0 mm; scape with pecten .... *M. modesta*
– Forewing grey with distinct white fasciae; forewing length 10.0–11.0 mm; scape with dense brush of short scales .... *M. partilella*

Key to the species of *Metanarsia* based on male genitalia

1. Sacculus without apical teeth 2
– Sacculus with apical teeth 3
2. Sacculus apically densely covered with short setae .... *M. alphitodes*
– Sacculus without apical setae; aedeagus very long, gnathos sucker-like .... *M. partilella*
3. Aedeagus with one teeth before apex, shorter than cucullus 4
– Aedeagus with two teeth before apex, about as long or slightly longer than cucullus .... *M. junctivittella*
4. Saccus relatively long; uncus with small apical depression; gnathos long and slender 5
– Saccus very short, broadly rounded; uncus with deep apical depression; gnathos short, triangular .... *M. incertella*
5. Vinculum lobes long and narrow .... *M. onzella*
– Vinculum lobes short and broad, rounded apically 6
6. Aedeagus longer than sacculus, distal part about as wide as basal part 7
– Aedeagus about length of sacculus, basal part twice width of distal part 8
7. Sacculus with deep depression at outer margin, apical teeth large .... *M. kosakewitshi*
– Sacculus without deep depression at outer margin, apical teeth small .... *M. dahurica* sp. n.
8. Saccus short; cucullus distinctly narrowed at base 9
– Saccus long; cucullus not narrowed at base .... *M. modesta*
9. Cucullus very short and broad; sacculus with two large apical teeth .... *M. piskunovi* sp. n.
– Cucullus longer, slender; sacculus with four small apical teeth .... *M. scythiella*

A key to the female genitalia is not provided because females are only known in seven out of ten species.



Figs. 2–9. Adults of *Metanarsia*. **2.** *M. modesta* ♂, Turkmenistan, wingspan 18 mm. **3.** *M. onzella* ♂, Turkmenistan, wingspan 16 mm. **4.** *M. kosakewitshi* ♂, holotype, Kazakhstan, wingspan 23 mm. **5.** *M. dahurica* sp. n., holotype ♂, Russia: Chitinskaja obl., wingspan 21 mm. **6.** *M. scythiella* ♂, paratype, Russia: Tuva, wingspan 25.5 mm. **7.** *M. piskunovi* sp. n., holotype ♀, Mongolia, wingspan 24.5 mm. **8.** *M. junctivittella* ♂, Turkmenistan, wingspan 16 mm. **9.** *M. junctivittella* ♂, Uzbekistan, wingspan 17 mm.

Species review

The *Metanarsia modesta*-group

Labial palpus relatively short, segment 2 much longer and broader than segment 3; aedeagus not exceeding length of cucullus; sacculus with apical teeth; gnathos long, slender.

Metanarsia modesta Staudinger, 1871 **Figs. 2, 18, 30, 48**

Metanarsia modesta Staudinger, 1871: 315. – Christoph 1885: 161, pl. 8 fig. 10.
Metanarsia (*M.*) *modesta kurdistanella* Amsel, 1959: 66, pl. 10 fig. 12, pl. 7 fig. 5 – Piskunov 1990: 96.

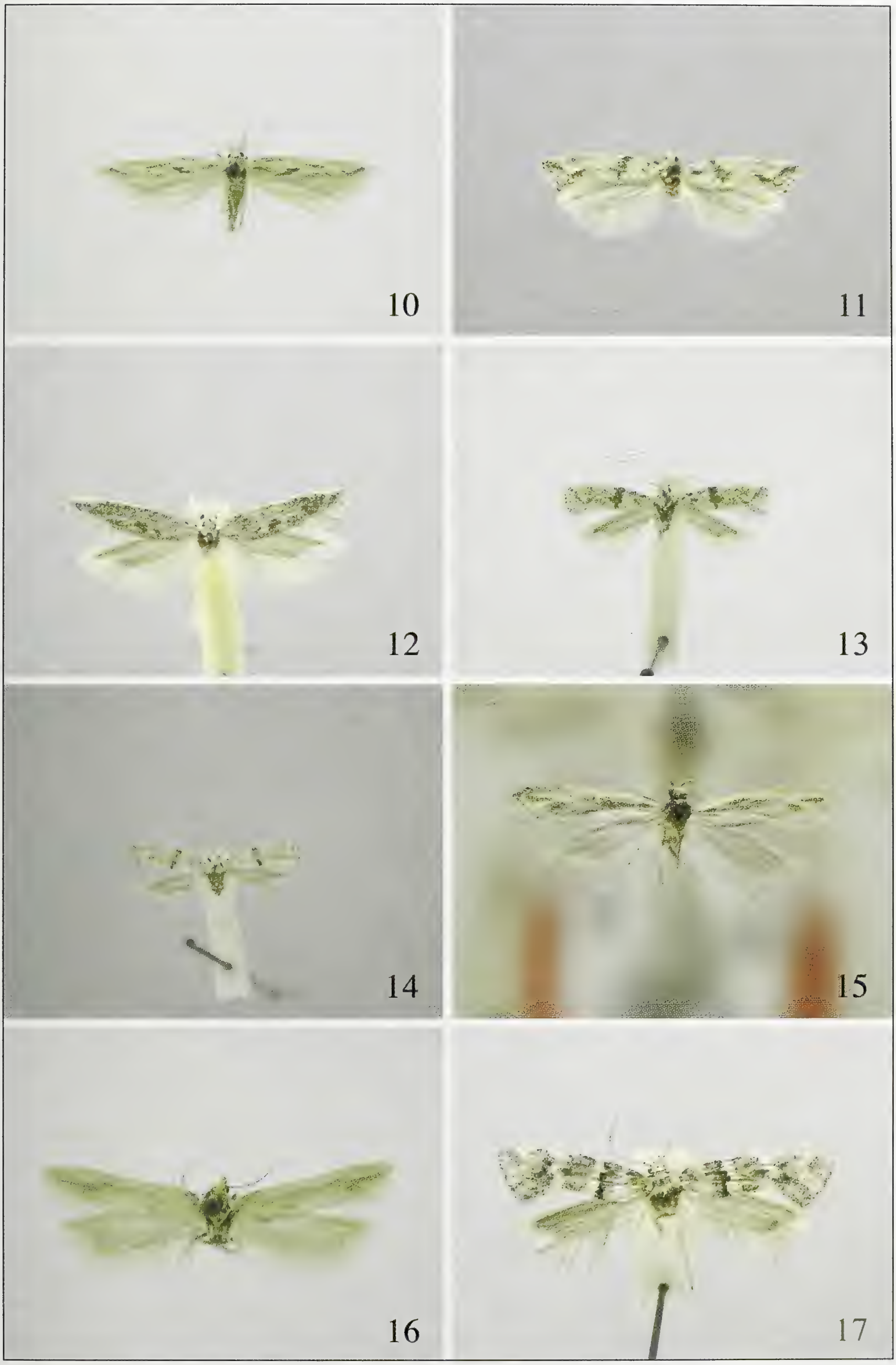
Material. Lectotype ♂ (designated here) with labels: handwritten “Sarepta Ch.” (black ink on green paper), printed “LECTOTYPE” (round, blue-edged BMNH label), printed “Origin.” (on pink paper), printed “Lectotype ♂, *Metanarsia modesta*, Stgr., teste K. Sattler, 1986”, printed “ex coll. STAUIDINGER” (on white paper) (ZMHB). – **Ukraine:** 6♂, 2♀, zap-k Kamennye Mogily, 30.vi–5.vii.1999, Bidzilya leg. (gen. prep. 46/03, 47/03); 2♂, zap-k Khomutovskaja step’, 15, 19.v.1996, Bidzilya leg.; 2♂, Prov. Kherson, Vessjolaja Bokovenjka (prope stat. Dolinskaja), 15.vi.1930, lum., Obraztsov leg.; 2♂, Khersonskaja obl., Askania Nova, step’, 19.vii.1981, Nesterov leg. (gen. prep. 7/03); 3♂, Nikolaev, 13.vi, 7.vii.1934, Obraztsov leg.; ♂, okr. Zaporozhija, Rybkhoz, 27.vi.1991, svet, Zhakov leg.; 2♂, Krim, Karadag, 23.vii.1924, light, Djakonov leg. (all ZMKU). **Russia:** 2♂, Rostov a/Don, 1, 2.vii.1929, Shtshegolev leg., coll. L. Sheljuzhko; 5♂, Saratoff, 29.vi.1896, coll. Krulikovsky; ♂, Casan, vi.[19]04, coll. Krulikovsky (all ZMKU). **Armenia**: 3♂, mts. Daralagez (Armenia), pag. Azizbekov (Pashalu), ca. 1650 m alt., (lum.), 19, 25.vii.1938, L. Sheljuzhko et N. Pavlitzkaja leg. Mus. Zool. Univers. Kijev (ZMKU). **Kazakhstan:** ♂, Uigursky r-n, 15 km NW Tchundzha, k.[ordon] Jasenevaja roshcha, na svet, 21.v.1991, Ustjuzhanin leg. (ZMKU). **Turkmenistan:** ♂, Aidere, 850 m, W Kopetdag, 1.vi.1986, Falkovitsh leg. (ZIN).

Redescription. Length of forewing 6.0–10.0 mm. Head, thorax, and tegulae with light grey, brown-tipped scales. Segment 2 of labial palpus very broad, densely covered with grey, brown-tipped scales, with dorsal surface and apex cream; segment 3 about one-fifth length of segment 2, almost entirely covered with scales of segment 2, at angle of about 120 degrees from segment 2. Scape dark brown with dense pecten of long hair-like scales, other antennal segments brown with white rings. Forewing light grey mottled with brown scales, with two-four indistinct spots along longitudinal axis of wing. Hindwing light grey.

Male genitalia. Uncus broad, with distinct apical depression. Cucullus finger-like, expanded apically, apex rounded, covered with short setae. Sacculus broad, with three or four small apical teeth and with deep emargination at inner margin, about half length of cucullus. Vinculum lobes broad, rounded. Saccus long, pointed apically. Aedeagus short, about length of sacculus, basal part bifurcated, strongly sclerotized, about twice width of distal part.

Female genitalia. Papillae anales sparsely covered with long setae. Apophyses posteriores about twice length of apophyses anteriores. Sternite VIII laterally broadly sclerotized, anterior margin narrow. Ductus bursae short. Corpus bursae long, evenly expanded proximally.

Variation. The forewing colour varies extensively from cream to grey brown and dark spots may merge to form short dashes; the male genitalia vary in the number of apical teeth of the sacculus and in the shape of the cucullus; there is some slight variation in the degree of sclerotization of sternite VIII in the female genitalia.



Figs. 10–17. Adults of *Metanarsia*: **10.** *M. junctivittella* ♂, Uzbekistan, wingspan 19 mm. **11.** *M. alphitodes* ♂ Algeria, wingspan 15 mm. **12.** *M. alphitodes* ♂, Turkmenistan, wingspan 14 mm. **13.** *M. alphitodes* ♀, Uzbekistan, wingspan 12 mm. **14.** *M. alphitodes* ♂, Mongolia, wingspan 11.5 mm. **15.** *Epidola halmyropis* ♂, holotype, W Kazakhstan (Indersky), wingspan 12 mm. **16.** *M. incertella* ♂, Mongolia, wingspan 23 mm. **17.** *M. partilella* ♂, Turkmenistan, wingspan 22 mm.

Remarks. *M. modesta* is easily recognizable externally by the cream forewing without prominent fasciae. The male genitalia resemble those of *M. dahurica* sp. n. but differ reliably in the shorter aedeagus, pointed saccus, and the shape of the sacculus; they differ from those of *M. schytiella* in the sacculus not being narrowed at base and the longer saccus. The female genitalia resemble those of *M. piskunovi* sp. n. and *M. alphitodes* but differ in the shape and the smaller size of the ductus and corpus bursae. Subspecies *M. m. kurdistanella* differs in the lighter fringe of the forewing as well as longer and narrower cucullus in the male genitalia. This subspecies should probably be considered a junior subjective synonym of *M. modesta,* but to clearly establish this presumed synonymy the type specimens of *M. m. kurdistanella* would have to be checked.

Life history. Adults fly from early May to late July; there is also a record (♂, 50 km NE Erzerum, 1600 m, 17.ix.1993, leg. Fibiger, ZMUC; Karsholt, pers. comm.) in September. Moths inhabit steppes up to about 1650 m in mountains (Turkey, Armenia).

Distribution. Ukraine; Armenia; Turkmenistan; Russia: South and East of European part; SE Kazakhstan. This species was also recorded from South Italy (Karsholt & Huemer 1995: 2), Romania, North Kazakhstan, South of Krasnojarskiy kray of Russia (Caradja 1920: 116), Uzbekistan (Gerasimov 1930: 33), Turkey, NE Iran (O. Karsholt, pers. comm.), Iraq (Amsel 1959: 66). A record from Mongolia (Emeljanov & Piskunov, 1982: 389, figs. 45, 46) must be referred to *M. piskunovi* sp. n.

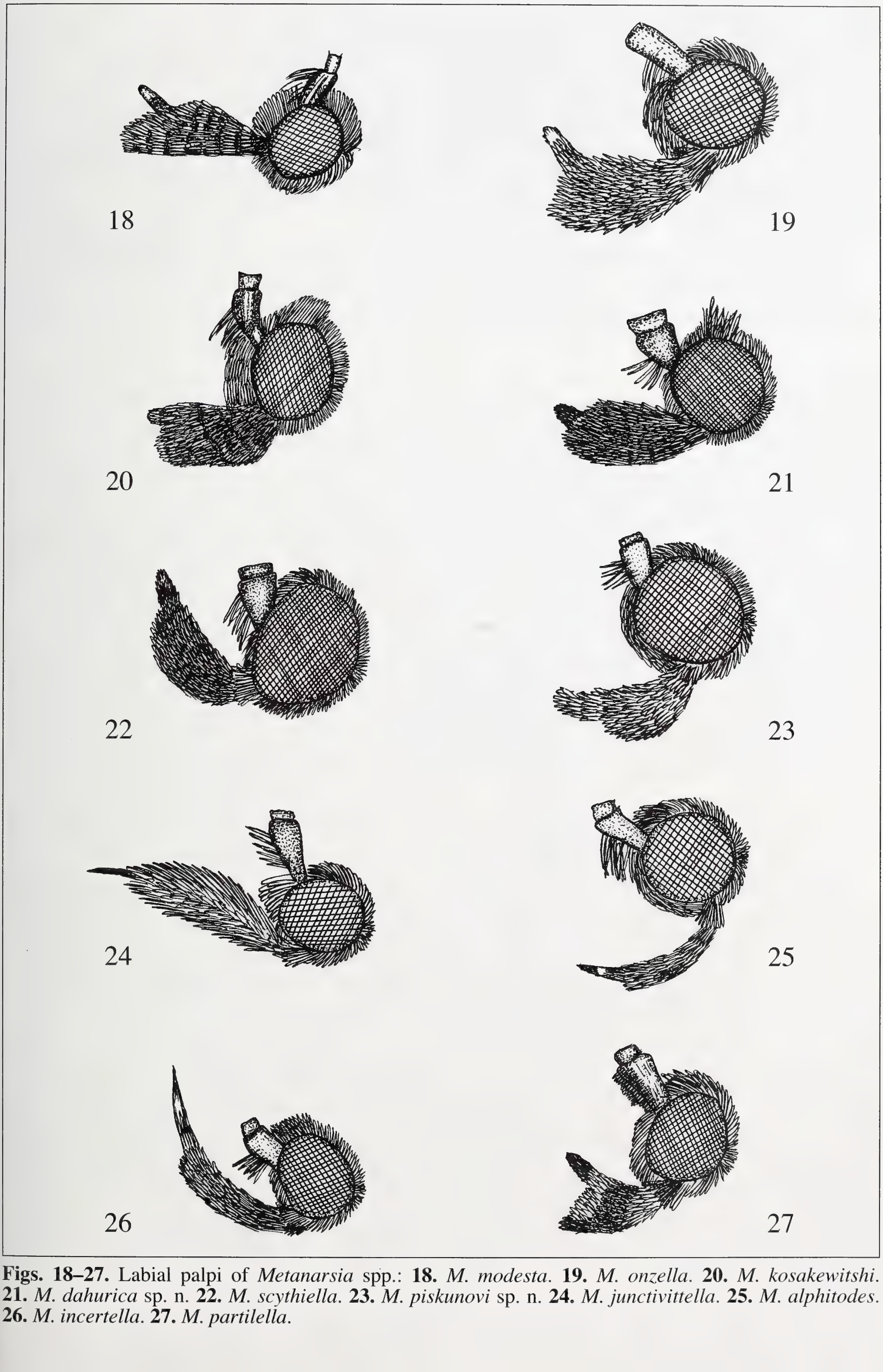
Metanarsia onzella Christoph, 1887 — Figs. 3, 19, 31

Metanarsia onzella Christoph, 1887b: 120, pl. 5 fig. 13 [adult].
Metanarsia (*Metanarsia*) *onzella* Christoph, 1887 – Piskunov 1988: 365, figs. 10–12 [male genitalia].

Material. Holotype ♂ (by monotypy) with labels: handwritten "Nuchur, ♂ (recto) 11.6.[18]82 Chr. 305 *Onzella* Orig. (verso)", green paper circle, printed "39" (on white paper), printed "Coll. Vel.[ikogo] Kn.[jazja] Nikolaja Mikhailovicha" (on white paper in Cyrillic characters), printed "Holotype ♂, *Metanarsia onzella* Christoph, teste K. Sattler, 1978" (on white paper), handwritten (Piskunov) "♂, *Metanarsia onzella* Christoph, 1887, Piskunov det., 1981" (on white paper), handwritten (Piskunov) "Holotypus" (on red paper) (ZIN). **Kazakhstan:** 3♂, YuV Kazakhstan, dolina reki Tcharyn, 15 km Z Tchundzha, Jasenevaja roshcha, 24.vi.1990, light, I. Kostjuk leg. (gen. prep. 29/03) (ZMKU). **Uzbekistan:** ♂, Ajakguzhumdy, 40 km O Dzhingil'dy, Kyzylkum, 4.vi.1969, M. Falkovitsh (ZIN). **Turkmenistan:** 3♂, Aidere, 850 m, W Kopetdag, 1, 2, 4.vi.1986, M. Falkovitsh (ZIN).

Redescription. Length of forewing 7.5–8.0 mm. Head, thorax, and tegulae covered with yellowish-grey, brown-tipped scales. Segment 2 of labial palpus straight, broad, expanded towards apex, densely covered with long brown scales, apex cream, about four times length of segment 3; segment 3 short, brown, with white apex, at angle of about 120 degrees from segment 3. Scape yellowish-brown with pecten of numerous long hair-like scales, other antennal segments brown with white rings. Forewing costal, posterior, and subapical areas with yellow patches, middle near posterior margin with diffuse yellowish-brown spot, outer margin dark grey. Hindwing grey.

Male genitalia. Uncus long and slender, with small apical depression. Cucullus relatively broad, finger-like, apex covered with short setae. Sacculus about two-thirds length of cucullus, with one lateral and three large apical teeth. Vinculum lobes long



Figs. 18–27. Labial palpi of *Metanarsia* spp.: **18.** *M. modesta*. **19.** *M. onzella*. **20.** *M. kosakewitshi*. **21.** *M. dahurica* sp. n. **22.** *M. scythiella*. **23.** *M. piskunovi* sp. n. **24.** *M. junctivittella*. **25.** *M. alphitodes*. **26.** *M. incertella*. **27.** *M. partilella*.

and narrow. Saccus triangular. Aedeagus about as long as sacculus, basal part bifurcated and strongly sclerotized, apex with distinct teeth.

Female. Unknown.

Variation. There is variation in the expression of yellow patches of the forewing and in the shape of the sacculus and vinculum lobes in the male genitalia.

Remarks. *M. onzella* is more similar externally to *M. junctivittella*, but differs reliably in the wing pattern and the shorter labial palpus. The male genitalia are clearly distinguished by long and narrow vinculum lobes.

Life history. Adults fly in June and August.

Distribution. SE Kazakhstan, Uzbekistan, Turkmenistan. Russia: South of European part (Sarepta) (K. Sattler, pers. comm.).

Metanarsia kosakewitshi **Piskunov, 1990** **Figs. 4, 20, 32**

Metanarsia (*Metanarsia*) *kosakewitshi* Piskunov, 1990: 95, figs. 1–3 [male genitalia].

Material. Holotype ♂ with labels: handwritten "Sary-Tau-Kumy, nizovija r.[eki] Ili, 12.vi.1977, I. S. Kumalev" (recto) "Alma-Atinskaja obl." (verso) (on white paper in Cyrillic characters), handwritten (Piskunov) on printed form "Holotypus *Metanarsia (Metanarsia) kosakewitshi Piskunov, sp. n.,* ♂" (recto) "Coll. Inst. Zool. AN Ukrainian SSR, Kiev, gen. prep. № 293, ♂, V. Piskunov" (verso) (on red paper), handwritten (Piskunov) on printed form "MIKR. PREP. № *293, ♂, holotypus*" (recto) "*Metanarsia (Metanarsia) kosakewitshi* Piskunov, sp. n., Kazakhstan, Piskunov" (verso) (on white paper) (SIZK).

Redescription. Length of forewing 11.0 mm. Head, thorax, and tegulae covered with yellowish-white scales. Segment 2 of labial palpus straight, slightly broadened towards apex, densely covered with long setae; inner surface yellowish-white, outer surface reddish-brown. Segment 3 of labial palpus straight, very short, entirely covered with long setae of segment 2. Scape reddish-brown with pecten of few, long hair-like scales, other antennal segments brown. Forewing uniformly reddish-brown. Hindwing grey.

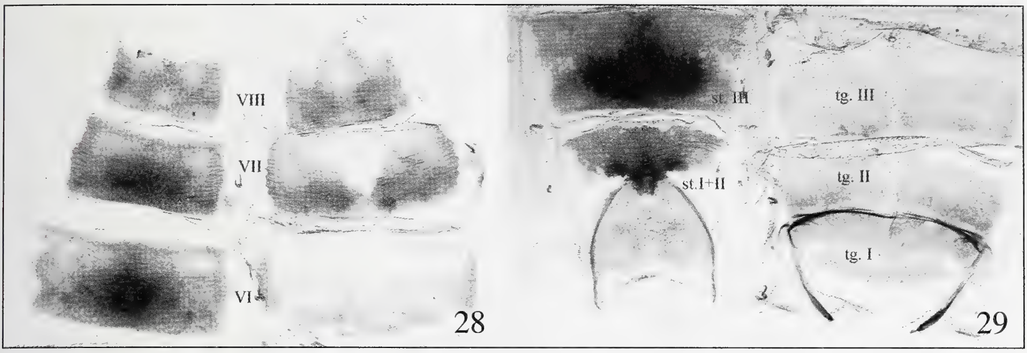
Male genitalia. Uncus relatively broad, slightly narrowed apically with very small apical depression. Gnathos weakly curved near middle, distal part slightly expanded, spoon-like. Cucullus finger-like, slightly curved at base, some exceeding length of uncus. Sacculus about two-thirds length of cucullus with deep depression at outer margin, apex with four distinct teeth. Vinculum lobes about one-third length of sacculus, rounded apically. Saccus narrow, triangular. Aedeagus bifurcated at base with distinct teeth before apex, sclerotized basally.

Female. Unknown.

Remarks. *M. kosakewitshi* Pisk. is more similar both externally and in the male genitalia to *M. dahurica* sp. n., but clearly differs in the uniformly reddish-brown forewing without fascia, slightly curved cucullus, smaller apical depression of uncus and the distinct deep depression at the outer margin of the sacculus; differences from *M. scythiella* are mentioned below.

Life history. Adults fly in June.

Distribution. SE Kazakhstan.



Figs. 28–29. Male abdominal segments: **28.** *M. scythiella*, segments VI–VIII. **29.** *M. scythiella*, segments II-III.

Metanarsia dahurica sp. n. **Figs. 5, 21, 33–34, 49**

Material. Holotype ♂, with labels: handwritten (Kostjuk) [**Russia:** Chitinskaya oblast'] "Daurskie stepi, vostochnyi bereg oz.[era] Barun-Torei, mys Mergen [Dahurian steppes, east bank of Barun-Torei Lake, Cape Mergen], 21.vi.1988, na svet, [on light] I. Kostjuk" (on white paper in Cyrillic characters), handwritten on printed form "Holotypus *Metanarsia dahurica Bidzilya*" (on red paper) (ZMKU). – Paratypes: 15♂, 2♀, labelled as holotype (gen. prep. 24/03, 42/03) (ZMKU). ♂, "**Mongolia**, Vostochnyi Aimak, Tamsag-Bulak, 21.vi.[1]976, Kerzhner" (gen. prep. 23/03) (ZIN).

Description. Length of forewing 9.0–11.0 mm. Head and thorax whitish-cream, tegulae cream with reddish-brown base. Labial palpus straight, segment 2 very broad, about five times length of segment 3, broadened towards apex, reddish-brown, dorsal surface cream; segment 3 very short, almost entirely covered with scales of segment 2. Scape reddish-brown with pecten of numerous long hair-like scales, other antennal segment brown with white rings. Forewing reddish-brown, bright, with distinct brown oblique transversal fascia from one-third posterior margin to half width of wing. Cilia reddish-brown. Hindwing light grey.

Male genitalia. Uncus relatively broad, with deep apical depression, densely covered with long setae. Gnathos broadened and slightly sclerotized at base, curved near apex. Cucullus straight with slightly broadened and rounded apex. Sacculus about two-thirds length of cucullus, with four small apical teeth. Vinculum lobes relatively broad, rounded apically. Saccus triangular. Aedeagus relatively long, distinctly bifurcated at base, with small teeth before apex.

Female genitalia. Papilla anales rounded apically, sparsely covered with long setae. Apophyses posteriores about 1.5 times length of apophyses anteriores. Segment VIII relatively broadly sclerotized laterally whereas anterior margin narrowly sclerotized. Ductus bursae short. Corpus bursae extremely long, evenly broadened proximally.

Variation. The forewing colour varies from bright reddish-brown to pale greyish-brown; the male from Mongolia is characterized by a broader cucullus and reduced apical teeth on the sacculus; two examined females showed no variation.

Remarks. In previous papers (Budashkin & Kostjuk 1994: 19; Kostjuk et al. 1994: 10;

Bidzilya et al. 1998: 48) *Metanarsia dahurica* was recorded as *M. kosakewitshi* Pisk., but my examination of the holotype of *M. kosakewitshi* showed that specimens from Transbaikalia reliably differ in forewing pattern, which has one distinct brown fascia. The male genitalia differ from those of *M. kosakewitshi* Pisk. in the straight cucullus, the sacculus with an indistinct depression on the outer margin and with smaller apical teeth, and the uncus with a deeper apical depression. The female genitalia of *M. dahurica* are clearly distinguished from those of all other known *Metanarsia* females by the very long and thin corpus bursae.

Life history. Inhabits steppe biotopes; adults fly in June.

Distribution. Russia: SE of Chitinskaja oblast'; Mongolia: East Aimak.

Derivatio nominis. Named after the type region.

Metanarsia scythiella Ponomarenko, 2000 Figs. 6, 22, 35

Metanarsia scythiella Ponomarenko, 2000: 223, fig. 1 [adult], figs. 2–5 [male genitalia].

Material. Paratype, ♂, **Russia,** Tuva rep. 50°40' N 92°58' E, 750 m, L. Ubsa-Noor, shore mead./ Nanophyton-steppe, 15.6.1995, Jalava & Kullberg leg. (gen. prep. 54/03) (ZMUH). Holotype not seen.

Redescription. Length of forewing 11.5 mm. Head, thorax, and tegulae yellow; base of tegulae and lateral sides of head mottled with pink. Labial palpus reddish-brown, inner surface lighter; segment 2 about twice width and four times length of segment 3, covered with long scales; segment 3 short, straight. Haustellum very short. Scape reddish-brown with pecten of few long hair-like scales, other antennal segments yellow. Forewing bright yellow, costal margin and termen reddish-pink, cilia yellow with some pink scales. Hindwing grey, cilia yellow.

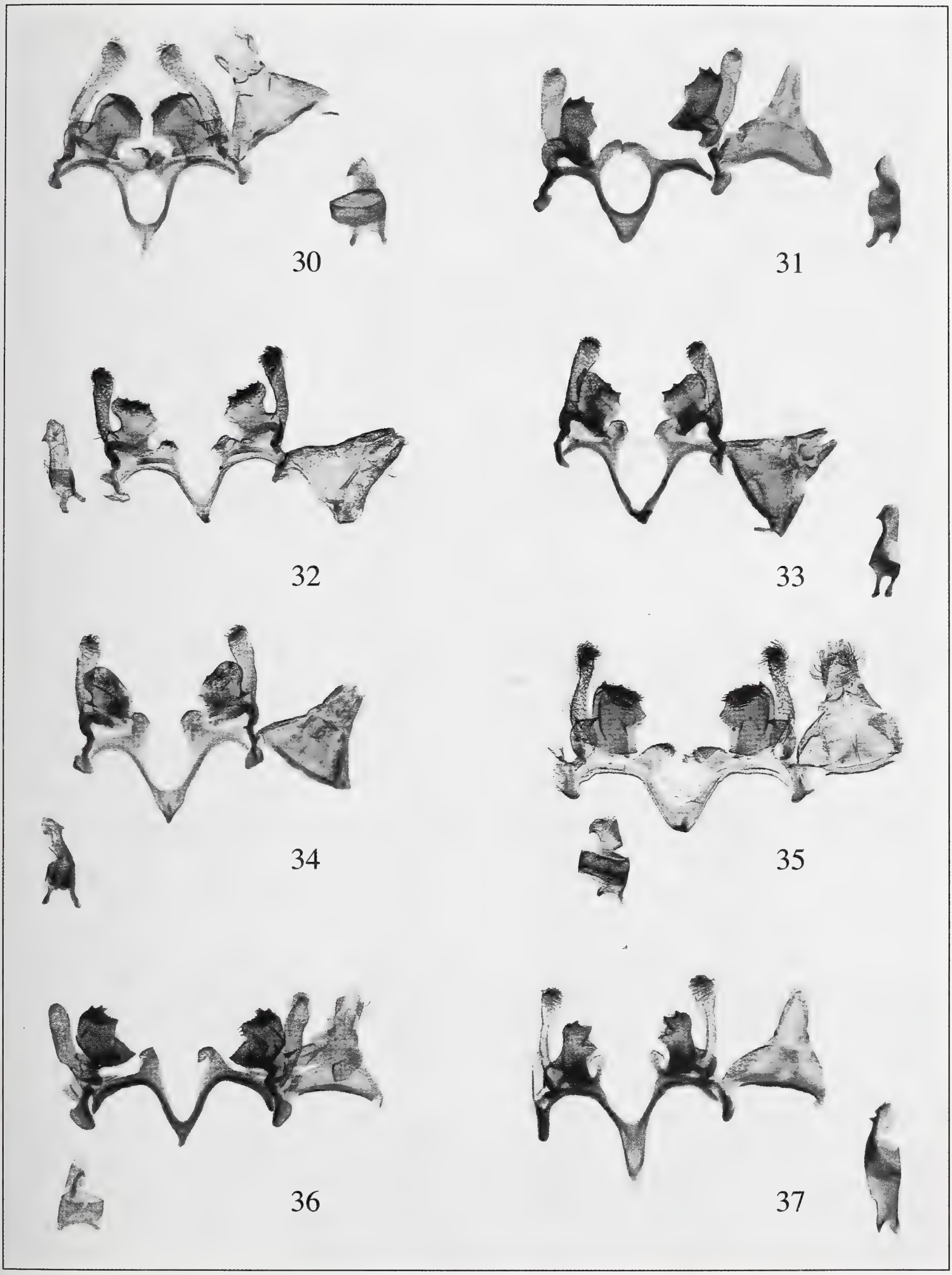
Male genitalia. Uncus broad, with apical depression. Gnathos relatively short, weakly expanded distally. Cucullus distinctly narrowed at base, weakly curved, with slightly broadened and rounded apex. Sacculus broad, about two-thirds length of cucullus, with one lateral and four small apical teeth, inner surface with triangular depression. Vinculum lobes relatively long, rounded, apically covered with short setae. Saccus triangular. Aedeagus about as long as sacculus, distinctly bifurcated at base, with small teeth before apex, proximal half about twice width of distal half.

Female. Unknown.

Remarks. *M. scythiella* is easily recognizable externally by its bright yellow forewing with reddish-pink costal margin. The male genitalia resemble those of *M. kosakewitshi* Pisk. and *M. dahurica* sp. n. but differ in the shorter and broader aedeagus, the sacculus without deep depression on the outer margin, the longer vinculum lobes, the distinctly narrowed base of the cucullus, and the shorter saccus. In genitalia, *M. scythiella* is also similar to *M. modesta* and *M. incertella* but differs from *M. modesta* in the basally narrowed sacculus and the shorter saccus; differences from *M. incertella* are mentioned below.

Life history. Inhabits arid habitats, adults fly just before sunrise (Ponomarenko 2000: 224).

Distribution. Russia: Tuva, Ubsa-Noor Lake.



Figs. 30–37. Male genitalia of *Metanarsia* spp.: **30.** *M. modesta*, Ukraine (gen. prep. 7/03) **31.** *M. onzella*, Kazakhstan (gen. prep. 29/03). **32.** *M. kosakewitshi*, holotype, Kazakhstan (gen. prep. 293). **33.** *M. dahurica* sp. n., paratype, Russia: Chitinskaja obl. (gen. prep. 24/03). **34.** *M. dahurica* sp. n., paratype, Mongolia (gen. prep. 23/03). **35.** *M. scythiella*, paratype, Russia: Tuva (gen. prep. 54/03). **36.** *M. piskunovi* sp. n., paratype, Mongolia (gen. prep. 6/04). **37.** *M. junctivittella*, Kazakhstan (gen. prep. 30/03).

Metanarsia piskunovi sp. n. Figs. 7, 23, 36, 50

Material. Holotype ♀ with labels: printed "**Mongolia**, Uver-Khangaiskiy Aimak, bliz vost.[ochnogo] ber.[ega] oz.[era] Tatsyn-Tsagan-Nur [Mongolia, Uver-Khangaiskiy Aimak, near east bank of Tatsyn-Tsagan-Nur Lake] 2.–4.viii.[1]969, M. Kozlov" (on white paper in Cyrillic characters), handwritten on printed form "Holotypus *Metanarsia piskunovi Bidzilya*" (on red paper), printed "gen. prep. 33/03" (on white paper) (ZIN) – Paratypes: 2♀, labelled as holotype (ZIN); ♂, Mongolia, Vost.[ochno]-Gob.[iiskiy] Aimak, 45 km S.[evero]-V.[ostochnee] Bajan-Munkha, na svet, 3.vii.[1]971, Kerzhner (gen. prep. 6/04); ♂, Mongolia, Vost.[ochno]-Gob.[iiskiy] Aimak, 50 km S.[evernee] Sain-Shanda, na svet, 31.vii.[1]971, Kerzhner (all ZIN).

Description. Length of forewing 10.0–11.0 mm. Head, thorax, and tegulae light yellow. Labial palpus weakly recurved; segment 2 broad, about twice length of segment 3, outer surface light brown, inner surface and apex cream; segment 3 short, densely covered with cream scales. Haustellum long. Scapus cream with pecten of few hair-like scales, other antennal segments dark grey with white rings. Forewing light yellow, termen with some brown scales; with small brown spot in middle and second spot at two-thirds length; indistinct diffuse dark oblique fascia from one-quarter of posterior margin to half width of forewing. Hindwing light grey.

Male genitalia. Uncus relatively narrow, with apical depression. Gnathos long, broadened distally. Cucullus very short and broad, constricted basally, apex rounded. Sacculus relatively narrow, with one triangular lateral and two large apical teeth. Vinculum lobes broad, rounded apically. Saccus triangular, pointed apically. Aedeagus short, about as long as sacculus, basal half about as long and twice as wide as distal half, base bifurcated, apex with small teeth.

Female genitalia. Papillae anales rounded apically, covered with long setae. Apophyses posteriores about 1.5 times length of apophyses anteriores. Segment VIII relatively narrowly sclerotized anterolaterally. Ductus bursae short. Corpus bursae broad and long.

Variation. The specimens from the type series show no variation both in habitus and in genitalia.

Remarks. This new species is more similar externally to *M. scythiella* but differs in the colour of the forewing which in *M. scythiella* is bright yellow with a pink costal margin and without dark spots. The male genitalia are similar to those of *M. scythiella*, but differ reliably in the broader and shorter cucullus and narrower sacculus with two large apical teeth. The female genitalia of *M. piskunovi* sp. n. resemble those of *M. alphitodes* but differ in the shorter and broader ductus bursae, the shape of the corpus bursae, and the much larger size.

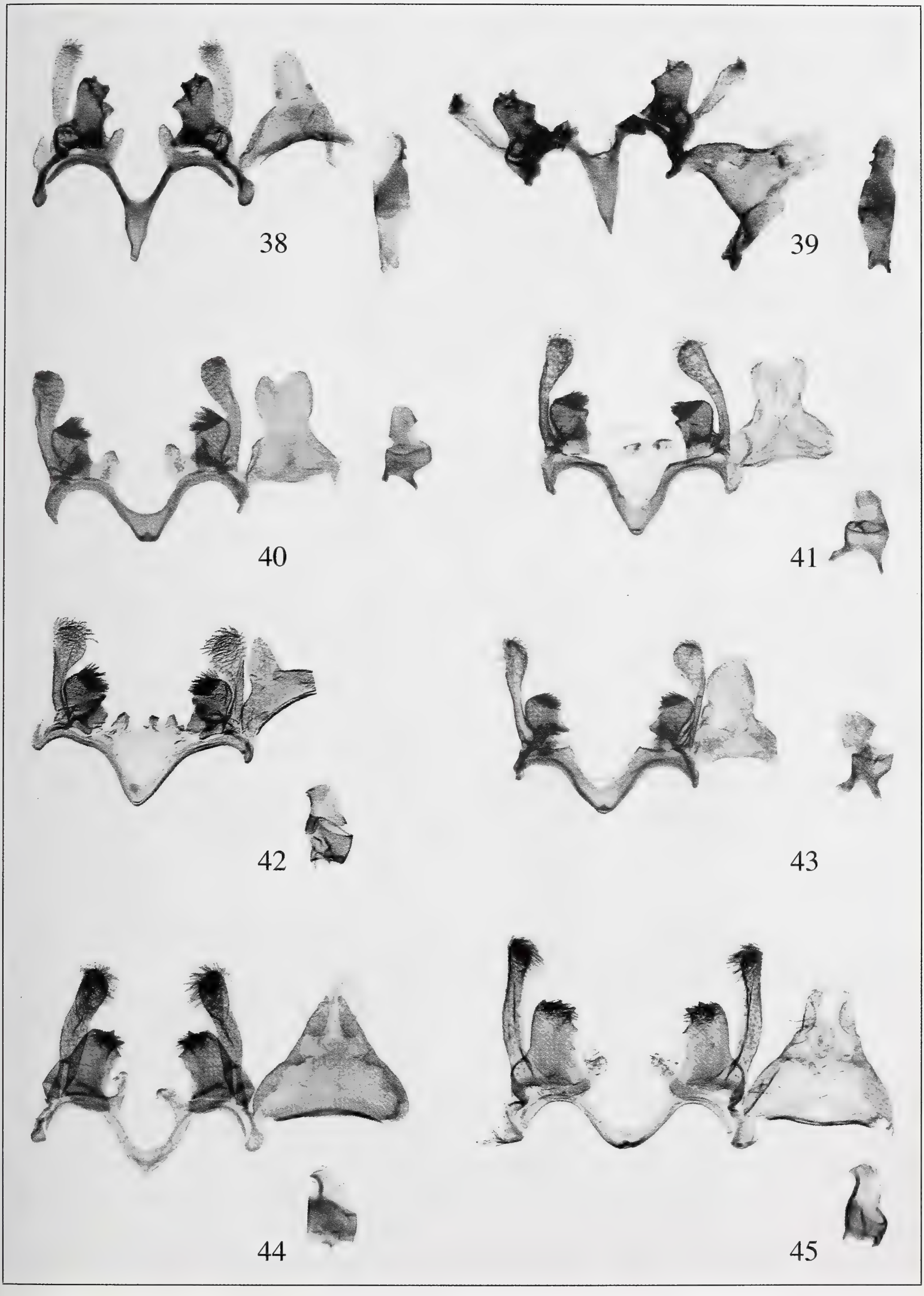
Life history. Adults fly from July to early August.

Distribution. Mongolia: Uver-Khangaiskiy Aimak, East Gobiiskiy Aimak.

Derivatio nominis. Named in honour of Dr. Vladimir I. Piskunov (Vitebsk, Byelorussia), who made an important contribution to the study of the gelechiid moths of the Palaearctic region, in particular with genus *Metanarsia*.

The *Metanarsia junctivittella*-group

Segment 2 of labial palpus very long, straight, covered with very long setae; aedeagus with two teeth before apex; saccus long; gnathos very long; R_4 reduced, R_3 and R_5 arising from corner of cell.



Figs. 38–45. Male genitalia of *Metanarsia* spp. **38.** *M. junctivittella*, Uzbekistan (gen. prep. 31/03). **39.** *M. junctivittella*, Tadzhikistan (gen. prep. 68/02). **40.** *M. alphitodes*, Algeria (gen. prep. 19/03). **41.** *M. alphitodes*, Uzbekistan (gen. prep. 26/03). **42.** *M. alphitodes*, Turkmenistan (gen. prep. 27/03). **43.** *M. alphitodes*, Mongolia (gen. prep. 20/03). **44.** *M. incertella*, Kazakhstan (gen. prep. 15/03). **45.** *M. incertella*, Uzbekistan (gen. prep. 52/03).

Metanarsia junctivittella Christoph, 1885 Figs. 8–10, 24, 37–39

Metanarsia junctivittella Christoph, 1885: 161, pl. 8 fig. 11.
Metanarsia (*Parametanarsia*) *junctivittella* Christoph, 1885. – Gerasimov 1930: 33, pl. 10 figs. 6–8.

Material. Lectotype ♂ (designated here) with labels: printed "TRANSCASPIA, Askhabad, 19.v.1882, H. Christoph" (on white paper), printed "LECTO-TYPE" (round, purple-edged BMNH label), handwritten (Christoph), "♂ ♀. Askhabad" (recto) (on white paper, in black box), "19 5 82" (verso), printed "*Metanarsia junctivittella* Christoph, H. Christoph det." (on white paper), printed "Christoph Coll., Walsingham Collection, 1910-427" (on white paper – BMNH registration label), handwritten (Christoph) "*Junctivittella* Chr." (on white paper, in black box). **Kazakhstan:** 8♂, Karatau Chr.[ebet], 10 km N Kentau, 600 m, svet, 19–21.v.1994, Pljushtch, Nesterov (gen. prep. 30/03) (ZMKU). **Uzbekistan:** 4♂, 70 km S Tamdy-Bulaka, Kyzylkum, 30.iv, 8.v.1965, Pastukhov; 3♂, Ajakguzhumdy, 40 km O Dzhingil'dy, Kyzylkum, 7.v.1966, 17.v.1969, Falkovitsh (all ZIN). **Turkmenistan:** 2♂, Badkhyz, kord.[on] Kyzyldzhar, svet, 21.iv.1981, 3.v.1980, V. Pechen'; ♂, Kushka, dolina reki, 21.iv.1981, Nesterov (ZMKU). **Tadzhikistan:** ♂, Staraja Pristan', 12 km Yu Dzhilykul' na reke Vahsh, svet, 20.v.1949, Yu. Shchetkin; ♂, Dzhilykul' na reke Vahsh, 16.iv.1949, Yu. Shchetkin (gen. prep. 28/03); ♂, Vahshskaja dolina, Molotovobadskiy r-n, 6-oi posiolok, 20.iv.1953, V. Degtjariova; ♂, Kondara, 1100 m, 29.vi.1956, Yu. Shchetkin (all ZMHB).

Redescription. Length of forewing 6.0–9.0 mm. Head, thorax, and tegulae yellow. Labial palpus straight, outer surface mottled with brown; segment 2 four times length of segment 3; segment 3 short, slender, covered with scales of segment 2. Scape yellowish-brown with dense pecten of numerous long hair-like scales, other antennal segments brown. Forewing dark yellow with brown longitudinal line from one-quarter of posterior margin to three-quarters length; subapical area and cilia mottled with brown. Hindwing light grey.

Male genitalia. Uncus relatively broad, densely covered with long setae. Gnathos weakly expanded distally, apex spoon-like. Cucullus slender, expanded towards apex. Sacculus about two-thirds length of cucullus, with one lateral and three apical teeth. Vinculum lobes relatively broad, triangular, pointed apically. Saccus long and slender, pointed apically. Aedeagus about as long or slightly longer than cucullus, basally bifurcated, with one small and one large teeth before apex, caecum long.

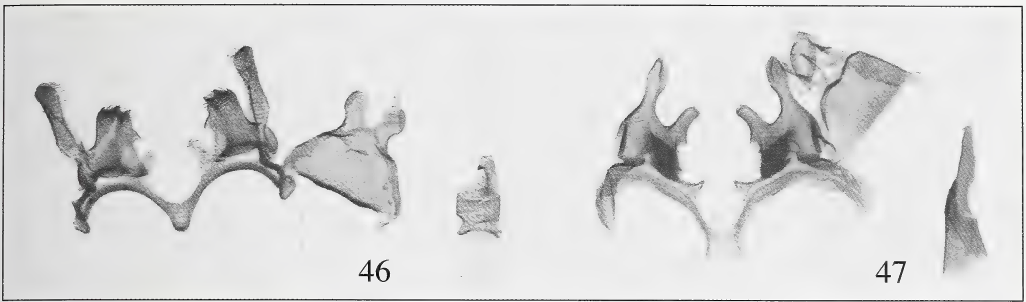
Female genitalia (after Gerasimov 1930: pl. 10 fig. 7). Papilla anales covered with setae. Apophyses posteriores about 1.5 times length of apophyses anteriores. Anterior margin of segment VIII narrowly sclerotized. Ductus bursae thin. Corpus bursae very long and relatively thin.

Variation. Externally very variable: specimens from Uzbekistan grey, with dark brown longitudinal line and numerous brown scales mainly along the veins; occasional specimens from Tadzhikistan light, uniformly yellowish-cream, without markings. The male genitalia vary in the width of the saccus, and the apical teeth of the sacculus may be reduced.

Remarks. *M. junctivittella* is clearly recognizable in the wing pattern, the very long labial palpus, the long saccus, the aedeagus with two teeth before apex, and the extremely long and thin corpus bursae.

Life history. Adults fly from the end of April to late June and readily attracted to light.

Distribution. South and SE Kazakhstan, Uzbekistan, Turkmenistan, Tadzhikistan; Afghanistan and Pakistan (K. Sattler, pers. comm.).



Figs. 46–47. Male genitalia of *Metanarsia* spp.: **46.** *M. incertella*, Mongolia (gen. prep. 21/03). **47.** *M. partilella*, Uzbekistan (gen. prep. 32/03).

The *Metanarsia alphitodes*-group

Labial palpus slender, weakly recurved; sacculus densely covered apically with short setae; gnathos very membranous, indistinct.

Metanarsia alphitodes (Meyrick, 1891) Figs. 11–14, 25, 40–43, 51

Calyptrotis alphitodes Meyrick, 1891: 56–57 – "Biskra [Algeria]; a series obtained one evening from some sheltered shrubs near the river bank".

Calyptrotis alphitodes Meyrick, 1891. – Clarke 1969: 393, pl. 195, figs. 1–1d – "Type: The male so marked in the British Museum, "Biskra, Algeria. 21.4.[18]90." – This action may be considered as an effective lectotype designation (ICZN Art. 74.5), not seen.

Metanarsia gobica Lvovsky & Piskunov, 1989: 554, figs. 43–45, **syn. n.** Holotype ♂ with labels: printed "MNR, Bajan-Khong.[orskiy] aimak, 140 km Yu. Shine-Dzhinsta, oaz.[is] Ehin-Gol, na svet, 26.vi.1981, L'vovskiy" (on white paper in Cyrillic characters), handwritten "26.vi" (recto) "svet" (verso) (on white paper), handwritten on printed form "Holotypus, ♂, *13872*" (recto) "*Metanarsia gobica* Lvovsky et Piskunov." (verso) (on red paper) (ZIN).

Metanarsia alphitodes (Meyrick, 1891). – Ponomarenko 2000: 222.

Material. **Algeria:** 2♂, Biskra, [18]87. Stdg. (gen. prep. 19/03) (ZMHB). **Kazakhstan:** ♂, Uigurskiy r-n, 15 km NW Tchundzha, Jasenevaja roshcha, 20.v.1991, P. Ustjuzhanin (ZMKU). **Uzbekistan:** 5♂, 2♀, Ajakguzhumdy, 40 km O Dzhingil'dy, Kyzylkum, 31.v.1975, 19.v.1970, 13, 15.v.1976, Falkovitsh (gen. prep. 27/03, 39/03) (ZIN). **Turkmenistan:** 2♂, ♀, Krasnovodsk (gen. prep. 27/03) (ZMHB); ♂, W Kopetdag, g.[ora] Sjunt, 19.v.1998, na svet, Z. Kljuchko, O. Torgonja (ZMKU). **Mongolia:** ♂, Mongolskiy Altai, 30 km N Biger, polupustynja, H–1350, 23.vi.1999, P. Ustjuzhanin; ♂, Mongolia, [Uver-Khangaiskiy Aimak] Tugrek, *Nitraria*, 21.vii.[19]70, l.[arva] zimuet, e. l. iii.[19]71, M. Kandybina (gen. prep. 20/03) (ZIN).

Redescription. Length of forewing 5.0–7.0 mm. Head, thorax, and tegulae covered with cream brown-tipped scales. Inner surface of labial palpus cream, outer surface brownish-cream; segment 2 about twice length of segment 3. Haustellum long, well developed. Scape brownish-cream with pecten of numerous hair-like setae, each antennal segment grey with white ring at base. Forewing cream mottled with brown; with two small indistinct spots near base, one brown spot of raised scales near posterior margin at half length, a brown, transversal, distally broadened fascia from half of costa to half width of wing, and greyish-brown scales in subapical area forming diffuse patches or one narrow streak along outer margin and near tornus. Hindwing light grey.

Male genitalia. Uncus long and broad, with small apical depression. Tegumen very short. Cucullus longer than uncus, weakly curved in middle, expanded distally. Sacculus about half length of cucullus. Vinculum lobes membranous, often indistinct, about one-third length of sacculus, broadened apically. Saccus triangular. Aedeagus short, about as long as sacculus, bifurcated and strongly sclerotized basally with distinct teeth before apex.

Female genitalia. Papillae anales sparsely covered with long setae. Apophyses posteriores about twice length of apophyses anteriores. Sternite VIII broadly sclerotized laterally, its anterior margin narrowly sclerotized. Ductus bursae broad, about as long as corpus bursae. Corpus bursae sub-oval.

Variation. The number of brown scales and their distribution can vary extensively and the brown subapical streak is often absent; males from Mongolia have the cucullus more slender medially and the vinculum broader; the three examined females showed no variation.

Remarks. *M. alphitodes* is easily recognizable externally by the slender, weakly recurved labial palpus, the unique wing pattern, and the small size. The male genitalia are clearly distinguished by the apically setose sacculus. The differences of the female genitalia from those of *M. piskunovi* sp. n. are mentioned above.

Life history. In Mongolia an adult was reared from *Nitraria* sp. (Nitrariaceae) in July. The larva hibernates. Adults fly from mid-May to the end of June.

Distribution. Algeria, SE Kazakhstan, Turkmenistan, Uzbekistan, Mongolia.

The *Metanarsia incertella*-group

Labial palpus long, strongly curved; gnathos short, triangular; ductus bursae thin, weakly sclerotized, clearly separated from corpus bursae.

Metanarsia incertella (Herrich-Schäffer, 1861) Figs. 15–16, 26, 44–46, 52

Anacampsis incertella Herrich-Schäffer, 1861: 31, pl. [23], fig. 156.

Epiparasia longivitella Rebel, 1914: 276, Taf. IV, fig. 12 – Caradja 1920: 94.

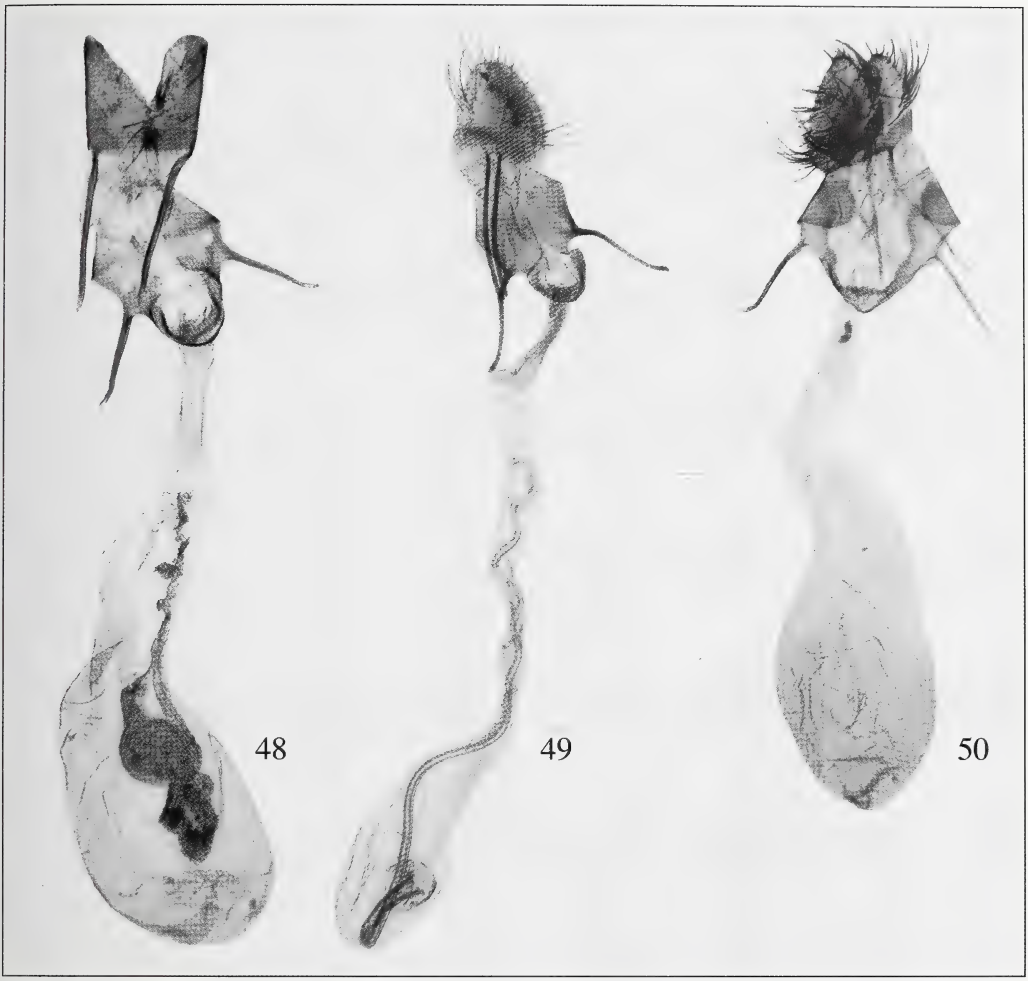
Epiparasia incertella (Herrich-Schäffer, 1861). – Caradja 1920: 94; Huemer, Karsholt, & Sauter 1996: 341–345, figs. 1–9.

Epidola halmyropis Meyrick, 1926: 270–271, **syn. n.** Holotype ♂ (by monotypy) with labels: handwritten (Meyrick) "Indersky, Uralsk, B. 26.4.07" (black ink on white paper), printed "Holo-type" (round, red-edged BMNH label), printed "Meyrick Coll., B.M. 1938-290" (on white paper – BMNH registration label), handwritten "*Epidola halmyropis* Meyr., Holotype ♂" (black ink on off-white paper), handwritten "data published as "June", ("4" on specimen) " (black ink on white paper), printed "Abdomen missing" (on blue paper) (BMNH).

Metanarsia (*Metanarsia*) *incertella* (Herrich-Schäffer, 1861). – Piskunov 1990: 95.

Metanarsia incertella (Herrich-Schäffer, 1861). – Ponomarenko 2000: 222.

Material. Holotype ♂ (by monotypy) with labels: handwritten "Sarepta | C. 60. | Type | zu A..kh.f.15b." (black ink on white paper in green box), printed "Holotype" (round, red-edged BMNH label), printed "Coll. Möschl[er]." (on white paper), printed "Origin." (on pink paper), printed, with handwritten inscriptions "Holotype ♂ | *Anacampsis ?* | *incertella* H.-S. | teste K. Sattler 1986" (on white paper), printed "ex coll. STAUIDINGER" (on white paper) (ZMHB). **Russia:** ♂, Kapustin Jar, Astrakh. obl., 10.8.74, na svet, Utochkin (ZMKU). **Kazakhstan:** 7♂, dolina reki Tcharyn, 15 km W Tchundzha, Jasenevaja roshcha, 7.vii.1994, svet, I. Kostjuk leg. (gen. prep. 15/03, 25/03) (ZMKU). **Uzbekistan:** ♂, ♀,



Figs. 48–50. Female genitalia of *Metanarsia* spp.: **48.** *M. modesta*, Ukraine (gen. prep. 47/03). **49.** *M. dahurica* sp. n., paratype, Russia: Chitinskaja obl. (gen. prep. 42/03). **50.** *M. piskunovi* sp. n., holotype, Mongolia (gen. prep. 33/03)

Ajakguzhumdy, 40 km O Dzhingil'dy, Kyzylkum, 9.v.1970, 17.v.1965, M. Falkovitsh (gen. prep. 40/03) (ZIN). **Mongolia:** ♂, Mongolskiy Altai, 30 km N Biger, polupustunja, H–1350, 23.vi.1999, P. Ustjuzhanin (gen. prep. 21/03) (ZMKU).

Redescription. Length of forewing 8.0–13.0 mm. Head, thorax, and tegulae cream. Labial palpus strongly projecting over head; segment 2 about 1.5–2 times length and 1.5 times width of segment 3, its outer surface yellowish-cream, inner surface lighter, off-white. Scape same colour as head with pecten of numerous long hair-like scales. Forewing uniformly yellowish-cream or with more or less distinct longitudinal line which can be divided into separate brown patches. Hindwing light grey.

Male genitalia. Uncus broad, with deep apical depression. Cucullus finger-like, broadened towards apex, apex rounded, covered with short setae, slightly longer than uncus. Sacculus about half length of cucullus, with one lateral and three apical teeth. Lobes of posterior margin of vinculum more or less prolonged, weakly setosed. Saccus short, broadly rounded. Aedeagus short, about as long as sacculus, proximal half strongly sclerotized, base bifurcated, apex with small teeth.

Female genitalia. Papillae anales elongated, densely covered with long setae. Apophyses posteriores about twice length of apophyses anteriores. Corpus bursae very long, evenly broadened distally.

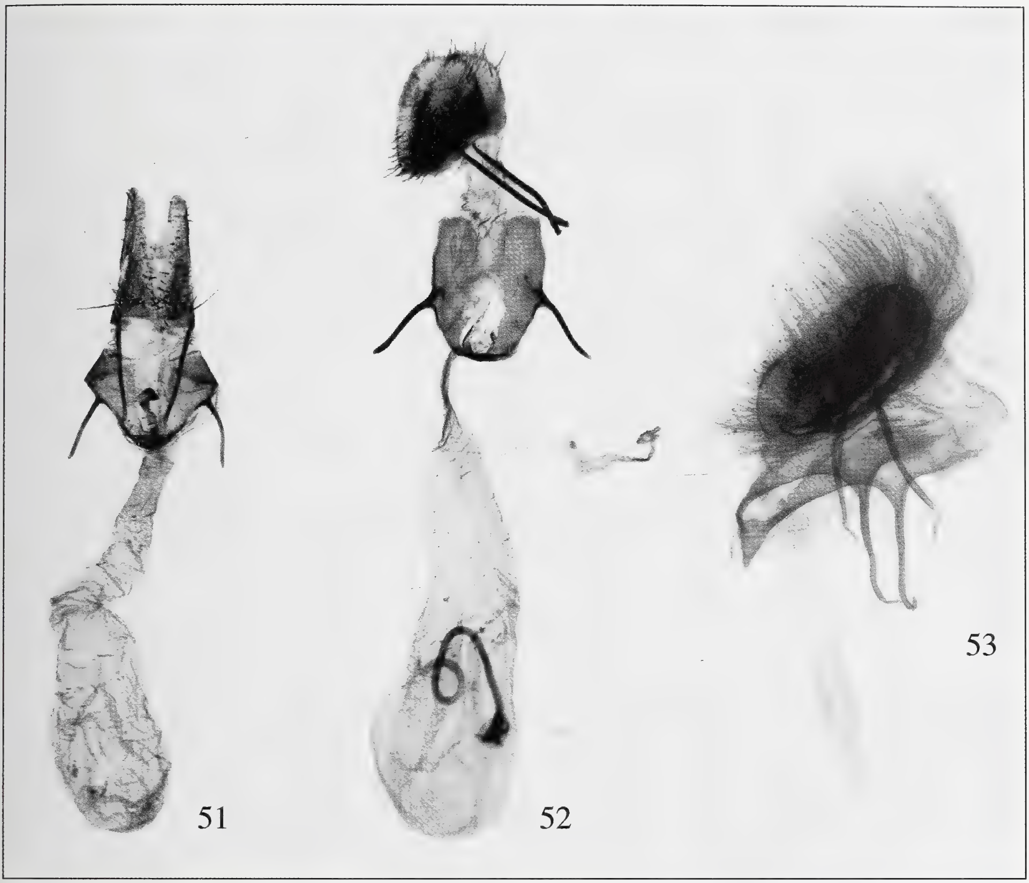
Variation. According to Huemer et al. (1996: 342) *M. incertella* shows extensive variation in the colour of the forewing and its markings from uniformly yellowish-cream without any marking to dark, greyish-brown with distinct brown lines and patches. At my disposal I had uniformly white specimens from Turkmenistan, yellowish-cream ones from Kazakhstan, whereas the male from Mongolia had a weakly expressed brown longitudinal line. Specimens from Turkey (Huemer et al. 1996, fig. 8) differed from specimens from Kazakhstan, Uzbekistan, and Mongolia in the shape of the vinculum lobes which was distinctly broader and rounded apically. There is also some variation in the shape of the apical depression of the uncus and in the length of the saccus in the male genitalia. One female from Tunisia (Huemer et al. 1996, fig. 9) slightly differed from females from Turkmenistan in the narrower lateral sclerotization of segment VIII.

Remarks. *M. incertella* is easily recognizable externally by the long and strongly recurved labial palpus. The male genitalia resemble those of *M. scythiella* and *M. kosakewitshi* but clearly differ in the narrower sacculus without deep triangular depression on the inner margin, the shorter saccus, the short triangular gnathos, the deeper apical depression of the uncus, and the shorter aedeagus. The female genitalia are clearly distinguished by the weakly sclerotized ductus bursae, which is distinctly separated from the corpus bursae.

Hypsipselon rigidellum var. *zeroudellum* Chrétien, 1915 (Tunisia), *Gelechia rhamiferella* Lucas, 1940 (Algeria), and *Epidola halmyropis* Meyrick, 1926 (W Kazakhstan, Indersky) were considered possible synonyms of *M. incertella* (Huemer et al. 1996: 341). This opinion was based on the examination of specimens that fit the original descriptions well and that originated from the type localities of these taxa. Thus, these presumed synonymies are quite plausible, but I was unable to check the type material of the first two taxa for confirmation. Unfortunately, the holotype of *E. halmyropis* lacks the abdomen, and although it corresponds well to *M. incertella* in wing pattern (Fig. 15), it differs in its unusually small size (wingspan 12 mm). Taking into consideration the extensive variation in external characters of *M. incertella* and the fact that W Kazakhstan (Uralsk) is the type locality for *E. longivitella*, I establish hereby the presumed synonymy of *M. incertella* Herrich-Schäffer, 1861 with *E. halmyropis* Meyrick, 1926 **syn. n.**

Life history. Adults fly from May to early August, up to about 2000 m in mountains (Huemer et al. 1996: 342).

Distribution. Russia (Volgogradskaja oblast', Astrakhanskaja oblast'), Kazakhstan, Uzbekistan, Mongolia. Known also from Spain, Algeria, Morocco, Tunisia, Russia: South and East of European part, South Siberia (Krasnojarsk), Turkey, West China (Caradja 1920: 94; Huemer et al. 1996: 342).



Figs. 51–53. Female genitalia of *Metanarsia* spp.: **51.** *M. alphitodes*, Uzbekistan (gen. prep. 39/03). **52.** *M. incertella*, Uzbekistan (gen. prep. 40/03). **53.** *M. partilella*, Uzbekistan (gen. prep. 45/03).

The *Metanarsia partilella*-group

Scape with dense brush of short setae; gnathos sucker-like; valva not entirely divided into cucullus and sacculus; aedeagus long, not bifurcated at base; papillae anales hairy; ductus bursae extremely short.

Metanarsia partilella (Christoph, 1887) Figs. 17, 27, 47, 53

Teleia partilella Christoph, 1887a: 167.

Teleia partilella Christoph, 1887. – Christoph 1889: 57, pl. 3 fig. 9.

Metanarsia (*Parametanarsia*) *partilella* (Christoph, 1887). – Piskunov 1988: 365, figs. 8–9.

Material. Lectotype ♂ (designated by K. Sattler in Piskunov 1988: 365) with labels: circle of green paper, handwritten "♂, Askhabad (recto) Partitella (verso) (on white paper), printed "coll. b.[yvshego] Vel.[ikogo] Kn.[jazja] Nikolaja Mikhailovicha" (on white paper, in Cyrillic characters), printed "Lectotype ♂, *Teleia partitella* Christ., teste K. Sattler, 1978" (on white paper), handwritten (Piskunov) "♂, *Metanarsia partitella* (Christoph, 1877), Piskunov det., 1981" (on white paper), printed "Hololectotypus" (on red paper). 2♂, 2♀, **Turkmenistan**, Repetek, SE Karakumy, 6,11,15,24.v.1981, Falkovitsh (gen. prep. 43/03, 45/03) (ZIN). ♂, **Uzbekistan,** Zhamansai, Kyzylkum, 25.v.1970, Falkovitsh (gen. prep. 32/03) (ZIN).

Redescription. Length of forewing 10.0–11.0 mm. Head white. Tegulae white mottled with grey scales mainly at base. Thorax covered with white, grey-tipped scales. Labial palpus relatively short; segment 2 broad, grey, apex white, about 1.5 times length of segment 3; segment 3 straight, grey, with few white scales. Scape grey, apex with white ring, other antennal segments dark grey with white ring. Forewing greyish-white, divided by two white fasciae into separated grey patches: first near base, second in middle and two small patches in subapical area; cilia grey. Hindwing dark grey.

Male genitalia. Uncus sub-oval, sparsely covered with short setae, with very small triangular apical depression. Gnathos large, strongly curved in distal one-third. Cucullus and sacculus broadly fused at base. Cucullus constricted at base, apex rounded, without setae. Sacculus about half as long and as wide as cucullus, without apical teeth. Vinculum lobes very short, triangular. Saccus short, sub-rectangular. Aedeagus longer than tegumen and uncus, slightly curved in middle, gradually narrowed towards apex, with very small subapical teeth.

Female genitalia. Papillae anales large, densely covered with very long, hair-like setae. Apophyses posteriores about as long as apophyses anteriores. Lateral part of segment VIII narrowly sclerotized; anterior margin triangular. Corpus bursae very thin and short, not exceeding length of papillae anales and segment VIII.

Variation. There is a slight variation in the shape of the grey patches of the forewing.

Remarks. *M. partilella* is easily recognizable externally by the unique wing pattern and the scape with a dense brush of short setae. The male genitalia are characterized by the very long aedeagus, the slender sacculus without apical teeth, and the large sucker-like gnathos. The female genitalia are clearly distinguished by the extremely short bursa and the papillae anales covered with very long, hair-like setae.

Life history. Adults fly in May.

Distribution. Turkmenistan, Uzbekistan.

Acknowledgements

I wish to express my gratitude to Drs S. Yu. Sinev, M. I. Falkovitsh, and A. L. Lvovsky for their assistance during my work with the collection of the ZIN and Dr K. Sattler (BMNH) for valuable information about some species and for providing a photograph of the holotype of *Epidola halmyropis*. I am very much obliged to I. Kostjuk (ZMKU), J. Kullberg (ZMUH), and Dr P. Ustjuzhanin (Novosibirsk) for loans and gifts of material, and to Dr R. Gaedike (DEI), Dr P. Huemer (TLMF), Dr B. Landry (MHNG), Dr W. May (ZMHB), Mr O. Karsholt (ZMUC), Dr Y. Nekrutenko (SIZK), Dr M. Nuss (MTD), Dr S. Sinev (ZIN) for critical comments on the manuscript, linguistic corrections and various help during the preparation of the manuscript.

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Gerhard M. Tarmann 2004. Zygaenid moths of Australia. A revision of the Australian Zygaenidae (Procridinae: Artonini). With colour paintings by František Gregor. – Monographs on Australian Lepidoptera **9**. – CSIRO Publishing, Collingwood (Australia). 248 pp. – Hardcover (ISBN: 0 643 06798 1) AU$ 180.00.

All Australian zygaenids belong to the subfamily Procridinae. Up until now, very little information was available on them, apart from old-style species descriptions. In a new volume of the Monographs on Australian Lepidoptera, Gerhard Tarmann (Innsbruck) provides a comprehensive revision of the Australian Forester moths, a group of 10 genera and 43 species. Nearly half of the taxa treated in the book, i.e. four genera and 21 species, are new to science, and information is provided for the first time on the life history of five genera.

The introductory chapters provide details on zygaenid morphology, life history (including phenology, larval host plants, cyanogenesis, defensive biology, pheromones, etc.), phylogeny, and historical biogeography. A cladistic analysis is given for the Australian genera of Artonini, with three extralimital genera of Procridini as outgroup. The characters and character states are described in detail, and the character-matrix and statistics for all trees are listed. However, no statistic values are given in the cladogram to show how much support exists at each node.

The second part of the book provides keys to all genera and species of Australian Procridinae. Each species is described in detail, with illustrations of male and female adults and genitalia, a diagnosis, and information on life history when available. A distribution map and a list of synonyms are also given for each taxon.

The illustrations are numerous and well prepared. Outstanding are the 114 finely detailed colour paintings of the moths shown larger than life size by the acclaimed artist František Gregor (Brno). The additional 448 figures include photographs of the genitalia of both sexes (so far as known) and of other diagnostic structures, scanning electron micrographs, and seven pages of colour photographs illustrating live preimaginal stages and adults as well as larval host plants and habitats.

A checklist of the taxa, a list of localities, and an index to scientific names make the book easy to use.

The book provides comprehensive and new information on Australian Zygaenidae and can be recommended to anybody who is interested in this fauna or in zygaenids in general, independently whether the interest is in systematics, life history, or conservation. Because of its comprehensive introduction to Zygaenidae, the book enables any biologist to find her/ his way into this group; therefore, it can be recommended also to researchers who are studying basic or applied topics on zygaenids.

FRANCESCA VEGLIANTE & MATTHIAS NUSS

Syrianarpia faunieralis sp. n. from the Cottian Alps of Italy (Crambidae: Scopariinae)

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Summary. In this paper a new species belonging to the genus *Syrianarpia* Leraut, 1982 is described. At the present state of our knowledge, three species are included in the genus *Syrianarpia*: *S. mendicalis* (Staudinger, 1879) from Iran, Turkey and Ukraine, *S. kasyi* Leraut, 1984 from Iran, and *S. faunieralis* sp. n. from the Cottian Alps (Italy).

Résumé. Le travail présente la description d'une nouvelle espèce du genre *Syrianarpia* Leraut, 1982. A l'état actuel de nos connaissances trois espèces appartiennent au genre *Syrianarpia*: *S. mendicalis* (Staudinger, 1879) de l'Iran, de la Turquie et de l'Ukraine, S. *kasyi* Leraut, 1984 de l'Iran, et *S. faunieralis* sp. n. des Alpes Cottiennes en Italie.

Key words. *Syrianarpia faunieralis* sp. n., Alps, Italy, Pyraloidea, Crambidae, Scopariinae.

Introduction

The description of the genus *Syrianarpia* by Leraut is quite recent (1982), the type species being *S. osthelderi* Leraut, 1982. Nuss (1999) established the synonymy between *S. osthelderi* and *S. mendicalis* (Staudinger, 1879) (*Metasia*). The main feature that characterises the genus in genitalia is the presence on the vesica of one cornutus, straight in shape and basally slightly enlarged, and the absence of protruding appendices on the inner side of the valva. On the underside of the forewing, as in many other genera belonging to the family Crambidae, the retinaculum is provided with a "hamus" that helps locking the frenulum in place. Till now the genus was represented by two species: *S. kasyi* Leraut, 1984 from Iran and *S. mendicalis* (Staudinger, 1879) from Turkey, Iran, and also from Ukraine (Crimea) (Bidzilya & Budashkin 2004). A third species is here described from the Alps in Western Europe. The limited data available on this genus indicate that their representatives are chiefly mountain species; specimens of *S. mendicalis* verified by Nuss (1999) were collected at elevations between 900 and 1600 m above sea level, while specimens belonging to *S. kasyi* were collected at 2000 m (Derbend, 25 km North of Teheran). The two male specimens of the species described below were collected around 2500 meters on a mountain summit of the Cottian Alps.

Methods

All comparisons involving biometrical data of the other *Syrianarpia* species were based on existing literature. Microphotographs were obtained with a Reichert Stereostar zoom microscope equipped with an Olympus digital camera.

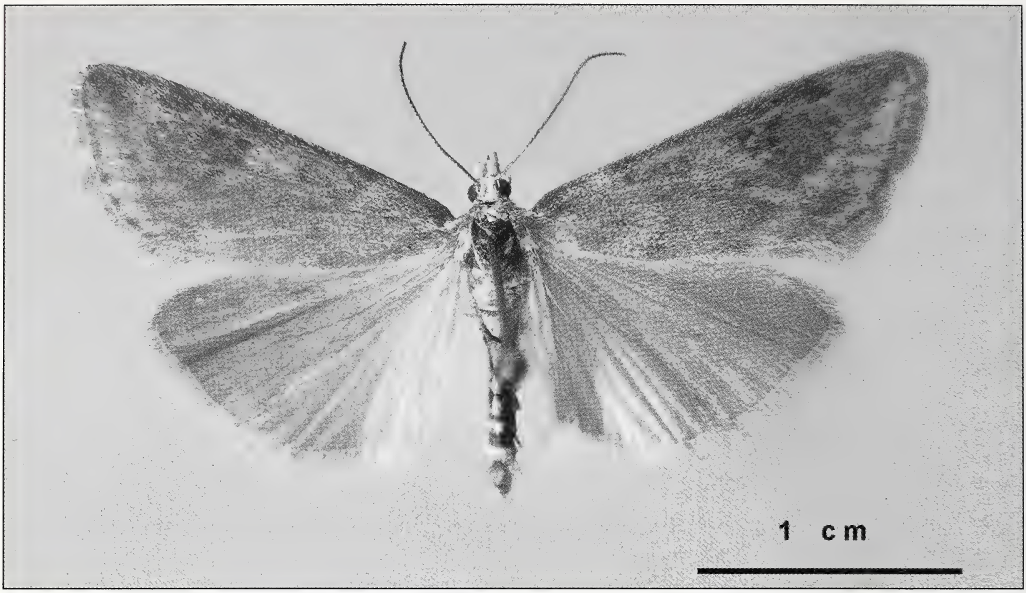


Fig. 1. *Syrianarpia faunieralis* **sp. n.** ♂ Paratypus.

Syrianarpia faunieralis sp. n.

Material. Holotype ♂, '[**Italy**], Piemonte, CN | Valle Grana | Cima Fauniera m. 2500, | 23.vii.2001, leg. M.Gianti', deposited at the Zoologische Staatssammlung München, Germany, prep. n. MG H 182. – Paratype ♂, '[**Italy**], Piemonte, CN | Valle Grana | Cima Fauniera m. 2500, | 19.vii.2001, leg. M. Gianti', coll. Gianti.

Description. A large species; forewing length 16 mm excluding fringe; fringe about 1 mm long; wingspan 31–33 mm. Forewing ground colour brownish-grey, paler in some areas forming faintly contrasted pattern; discoidal stigma well marked, especially distal one; postmedian and subterminal lines very distinct. Hindwing slightly paler, faintly scaled. Head frontal and occipital regions whitish to pale grey, upperside of palpi concolorous, underside brown (Figs. 3–4). Antennae approximately 8 mm long.
Male genitalia. Uncus progressively slender from base to distal end, apex blunt. Gnathos as long as uncus and sharply pointed. Juxta rather long (0.8 mm), regularly narrowing and rounded at apex. Valva rounded, median portion wider than basal and apical ones (see Fig. 2). Phallus about 1.5 mm long; ductus ejaculatorius inserting near middle; cornutus about 0.5 mm long.

Diagnosis. The forewings are pointed and their shape and pattern remind those of *S. mendicalis*, but *S. faunieralis* is larger than all other members of the genus (forewing length 16 mm versus 7–11 mm). In male genitalia the uncus is progressively decreasing in width toward apex, whilst in *S. mendicalis* it is slightly enlarged just before the tip, or nearly globulous. The valva is more rounded in *S. faunieralis*, especially the lower margin, while it is very straight in *S. mendicalis*, the costa in particular. The juxta is evenly tapering in *S. faunieralis*, whereas it has a conspicuous and long pointed tip in *S. mendicalis*. The insertion of the ductus ejaculatorius in the new taxon is located near the middle of the phallus, while it is closer to the anterior tip in *S. mendicalis*. The

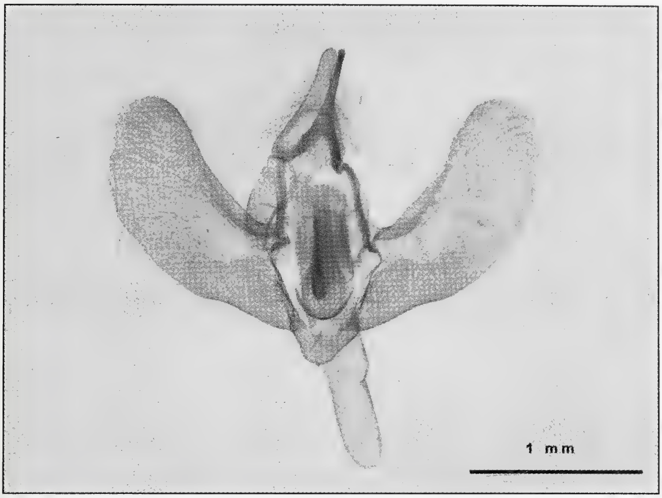


Fig. 2. *Syrianarpia faunieralis* **sp. n.** Holotypus, ♂ genitalia with phallus in situ (prep. MG H 182).

cornutus is approximately one third the length of the phallus in *S. faunieralis*, whilst in *S. mendicalis* it is about one fifth of that length. *S. kasyi* has genitalia roughly similar to those of the new species, but they are distinctly smaller, the juxta is more pointed at the tip, and both the wing pattern and shape are very different.

Derivatio nominis. From the type locality, Cima Fauniera, a mountain in the Grana Valley, Southern Cottian Alps, Piedmont, Italy.

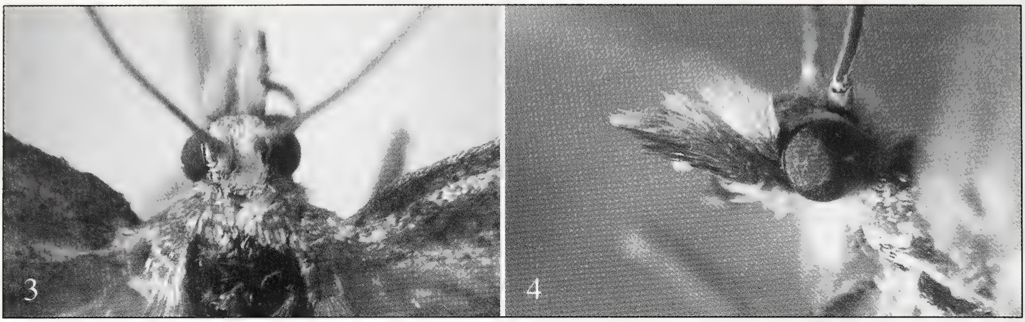
Distribution. Known only from the type locality. Very likely the species could be present in the French Cottian Alps.

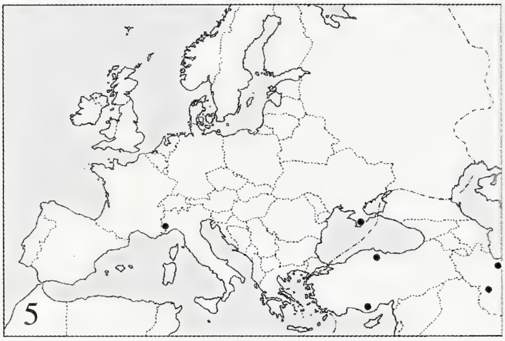
Discussion

The discovery of this new species from a relatively well-investigated geographical area is just another example of how mountain districts are worth studying. The finding is even more surprising due to the size of the new described insect, which can be placed amongst the largest European Scopariinae. Even with the limited present state of knowledge, we can reasonably suppose that *S. faunieralis* represents an endemic alpine species, possibly restricted to the southwestern Alps. Further investigations of the neighbouring mountainous districts will probably disclose the real distribution range of the species.

More than 220 species of Lepidoptera are today known to be endemic to the Alps (Huemer 1998) and a large percentage of them are exclusive to one sector, i.e. western, central, or eastern Alps. Almost all of these species are characteristic of alpine and subalpine elevations, whilst only very few endemics are typical of the collin or nival altitudinal zones.

So far, very little is known about *S. faunieralis*. No females were collected nor observed. The larval food, early stages, and life history are unknown. Little more is documented about the habitat. The locality is the same as that of the Italian colony of the geometrid moth *Glacies belzebuth* (Praviel, 1938), an alpine endemic (cf. Gianti 2002). The biotope is extremely fragmentary, i.e. greatly variable from place to place, even on short distances, and this makes it difficult to obtain information on the real ecological





Figs. 3–5. *Syrianarpia faunieralis* **sp. n.** ♂ Paratypus, head. **3.** Dorsal view. **4.** Lateral view. **5.** Known distribution of the genus *Syrianarpia* Leraut, 1982.

requirements of the species. Moths appear to be uncommon. During several excursions in search of *G. belzebuth*, only two adults of *S. faunieralis* were observed. These were discovered flying in daylight near the ground, in small grass patches amongst emerging rocky substrate.

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Accelerated development of *Maculinea rebeli* larvae under artificial conditions (Lycaenidae)

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Abstract. In the years 2000 to 2003, 93 *Maculinea alcon* ([Denis & Schiffermüller], 1775) larvae from three localities in Hungary and 261 *M. rebeli* (Hirschke, 1904) larvae from three localities in Hungary and from one locality in Austria were introduced into 103 *Myrmica* colonies in the laboratory. Seven specimens of *M. rebeli* pupated after only about a month in artificial *Myrmica scabrinodis* Nylander, 1846, *My. sabuleti* Meinert, 1860 and *My. salina* Ruzsky, 1905 nests. This phenomenon was found in each of the four studied populations. Two pupae successfully eclosed, one 32 and the other 47 days after adoption. The other five pupae died. These results confirm observations that the developmental time of *M. rebeli* larvae can be plastic. A similarly accelerated development of *M. alcon* larvae was never observed. The accelerated development of *M. rebeli* larvae might be attributed to (1) the higher temperatures in the laboratory as compared with natural conditions, and/or to (2) the artificial *Myrmica* nests which were more exposed to light than under natural conditions, and/or to (3) the balanced artificial diet that the *Myrmica* colonies received.

Key words. *Maculinea, Myrmica,* myrmecophily, host ant, ant diet, accelerated development.

Introduction

Larvae of *Maculinea* van Eecke, 1915 are obligate parasites of *Myrmica* Latreille, 1804 (Hymenoptera: Formicidae) colonies for most of their life. It has long been known that the butterflies have an annual life cycle, with larvae living for about 10–11 months in *Myrmica* ant nests (Thomas 1995; Thomas & Elmes 1993, 2001; Thomas & Wardlaw 1992; Thomas et al. 1989, 1993; Wardlaw et al. 2000). More recently, it has been shown that some larvae live for an additional year in the ant nests, for a total of about 22–23 months (Als et al. 2001; Elmes et al. 2001; Schönrogge et al. 2000; Thomas et al. 1998). While rearing *Maculinea rebeli* (Hirschke, 1904) larvae in the laboratory, an unexpectedly accelerated development was observed, with pupation as soon as a month after adoption.

Although genetic (Als et al. 2004; Bereczki et al. in press) and morphological (Pech et al. 2004) differentiation between the traditionally separated species *M. alcon* ([Denis & Schiffermüller], 1775) and *M. rebeli* is rather low, the two taxa have different physiological and ecological adaptations (see e.g. Schönrogge et al. 2000; Thomas et al. 1989). I use *'M. rebeli'* for populations which develop on *Gentiana cruciata* and *'M. alcon'* for those which develop on *G. pneumonanthe*. However, the host plant affinities of these two taxa need to be re-investigated for their significance for identification purposes (see e.g. Kolev 2002; Munguira & Martin 1999; Sielezniew & Stankiewicz 2004).

Material and Methods

Between 2000 and 2003, 93 *Maculinea alcon* and 261 *M. rebeli* larvae were reared in 103 artificial laboratory colonies of *Myrmica*. For this purpose, plants of

G. pneumonanthe with eggs of *M. alcon* from three localities (Hungary: Fülesd, Gyöngyös, Mátraszentimre) and plants of *G. cruciata* with eggs of *M. rebeli* from four localities (Austria: Hochschwab; Hungary: Bükk-plateau, Bükkszentkereszt, Jósvafő) were collected. In the laboratory the gentians were kept in glasses of water placed in plastic basins, and could be kept fresh for 2–3 weeks while the *Maculinea* larvae emerged. Fourth instar larvae were collected using a fine brush as they dropped from the flowers in the evenings, and were transferred straight into the foraging arena of an artificial *Myrmica* nest to be adopted by the ants. Before introduction, the length of each caterpillar was measured with a ruler. Caterpillars were remeasured after one month by putting the ruler to the glass that covered the artificial nests.

The *Myrmica* colonies usually were collected from the same sites as the gentians. Each colony contained at minimum one queen and 100 workers. They were kept in Debrecen (Hungary) in unheated nests (made from clay and glass) joined by silicon tubes to plastic arenas. These nests were not covered to exclude the light, but were kept in places that never received direct sunlight. The laboratory was not air-conditioned in the summer, but was heated in the colder seasons. The temperature that the *Myrmica* nests experienced was less variable than under natural conditions, and was often up to 25° C in the warmer periods. A part of the nest area was always kept wet by a cotton wool strand that connected the clay with water. To feed the ants, the arenas of the nests were always provided with a cube of sugar, and various insects (mainly cut-up mealworms, larvae and pupae) as well as granules of a dry diet at a minimum of once a week (see appendix). The cube of sugar provided continuous food while the dry diet provided the proteins (and maybe essential vitamins and minerals) when there were not enough insects to feed the ant colonies.

The following *Myrmica* species (identified by Tartally & Csősz) were used: *My. lonae* Finzi, 1926 (1 culture); *My. vandeli* Bondroit, 1920 (1 c.); *My. rugulosa* Nylander, 1849 (1 c.); *My. salina* Ruzsky, 1905 (3 c.); *My. specioides* Bondroit, 1918 (3 c.); *My. gallienii* Bondroit, 1919 (7 c.); *My. schencki* Viereck, 1903 (8 c.); *My. ruginodis* Nylander, 1846 (8 c.); *My. rubra* (Linnaeus, 1758) (9 c.); *My. sabuleti* Meinert, 1860 (9 c.) and *My. scabrinodis* Nylander, 1846 (35 c.).

When a butterfly larva pupated, it was removed from the ants using a pair of fine forceps and placed in a plastic box with ventilation holes and a moist sponge pad at the bottom. This was thought to be important because the ants damage the eclosed butterflies if they are not able to escape from a closed artificial nest and if they are not discovered and separated in time (Elfferich 1988). Voucher samples of ants, dead pupae, exuviae, and butterflies are stored in the author's collection.

Results

Several larvae died during the period of adoption and the next few days. After this critical period their mortality was lower and the *M. rebeli* larvae usually grew very quickly. They were about 3 mm long on introduction, and usually they had grown to about 15 mm a month later. However, seven of them pupated after about a month in different ant nests. These were associated with three *Myrmica* species and came from

Tab. 1. The *Maculinea rebeli* larvae that pupated in about a month in the laboratory.

Locality	Host	Date of adoption	Date of pupation	Date of eclosion
Hungary / Bükk-plateau	*My. sabuleti*	27.07.2002	15.08.2002	28.08.2002
Hungary / Bükk-plateau	*My. scabrinodis*	27.07.2002	28.08.2002	died
Hungary / Bükkszentkereszt	*My. scabrinodis*	11.07.2002	13.08.2002	27.08.2002
Hungary / Bükkszentkereszt	*My. scabrinodis*	11.07.2002	13.08.2002	died
Hungary / Jósvafő	*My. salina*	11.07.2002	15.08.2002	died
Hungary / Jósvafő	*My. scabrinodis*	11.07.2002	10.08.2002	died
Austria / Hochschwab	*My. sabuleti*	14.07.2003	16.08.2003	died

each of the four *M. rebeli* populations studied (Tab. 1). Such a quick development in *M. alcon* larvae was never observed in my experiments during the first months. The *M. alcon* larvae also were about 3 mm long on introduction, but they had grown only to ca. 5 mm a month later and remained about this size in the winter. Two male butterflies from the seven pupae emerged. One of them eclosed 32, the other 47 days after adoption as freshly moulted fourth instar larvae (Tab. 1). These specimens were smaller than average (the forewing length of the one from Bükkszentkereszt was 15 mm and the one from Bükk-plateau 15.5 mm), but similarly small specimens often occur under natural conditions. The fast-developing specimens did not show any other obvious differences compared with field-grown specimens. The other five pupae became rotten or dried out under the unnatural air humidity of the laboratory.

Discussion

The fast-pupating larvae were reared by three different species of *Myrmica*: *My. scabrinodis, My. sabuleti*, and *My. salina*. According to field observations, the former two are suitable host ants for *M. rebeli* in Hungary (Tartally & Csősz 2004) and *My. sabuleti* is also suitable in Eastern-Austria (Steiner et al. 2003). However, there are no records of *My. salina* as a host of *M. rebeli* yet (Als et al. 2004; Tartally & Csősz 2004). It is important to note that in well-fed laboratory nests the survival of adopted larvae is usually better than in nature (Elmes et al. 2004; Schönrogge et al. 2004).

The fast development of *M. rebeli* under laboratory conditions might be caused by (1) the warmer temperatures in comparison to natural conditions (Wardlaw 1991; Wardlaw et al. 1998), and/or (2) the artificial *Myrmica* nests being more exposed to light than under natural conditions (the more abundant light could influence the larval development of lycaenid butterflies; see e.g. Høegh-Guldberg 1968), and/or (3) the more balanced diet the *Myrmica* colonies received – thus, my diet seems to be suitable for *Myrmica* colonies as supplementary food.

Elmes & Thomas (pers. comm.) recorded similarly short times of development for *M. rebeli* from the Pyrenees and the Southern Alps under unnaturally warm conditions and with abundant food. Hence, an accelerated development is known from several populations and is not a unique phenomenon. These results support the plasticity of the developmental time of *M. rebeli* as the larvae develop during one or two years in nature (Elmes et al. 2001; Schönrogge et al. 2000; Thomas et al. 1998) or have a conspicuous accelerated development within one year under favourable conditions. In addition, based on my own observations, there is no indication of a two-year development of *M. rebeli* in Hungary since I have never found semi-developed *M. rebeli* larvae in *Myrmica* nests during the flying period. On the other hand, some semi-developed *M. alcon* larvae were observed in various Hungarian sites during the flying period. According to Varga (pers. comm.), 'dwarf' adults of *M. rebeli* regularly appear in several Hungarian populations at the end of the flying period (end of June to mid-July, depending on year and elevation). However, in the laboratory, the two dwarf specimens eclosed in late August. This suggests that undernourished *M. rebeli* larvae may also fully develop within one year under natural conditions and a partly bivoltine life cycle in nature seems to be unlikely. It is known that the growth of the one-year *M. rebeli* larvae tend to be fast immediately after adoption, stops during winter (meaning that they go into diapause in nature), and resumes in the spring just before pupation (Thomas et al. 1998). However, according to my laboratory observations the development of *M. rebeli* larvae can be continuous (without diapause) under favourable conditions, contrary to that of *M. alcon*. These differences were also observed when I reared *M. alcon* and *M. rebeli* larvae under the same laboratory conditions but in *Manica rubida* (Latreille, 1802) colonies (Tartally 2004). Further studies are still necessary to investigate the temporal dynamics of the development within *M. rebeli* and *M. alcon* populations and to understand the ecological circumstances influencing these dynamics.

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Appendix

The recipe of the dry diet

Ingredients.
100 cm^3 (=14–15 g) freeze-dried fish [1]
1 level tablespoon of flour
1 pinch of sea salt
1 vitamin pill [2]
1 egg

[1] You can buy it in well-equipped pet shops as food for cats and turtles (I used a Hungarian product: Bio-Lio). If you cannot find freeze-dried fish you can dry some lean pieces of cooked fish or chicken in the sun or under an infra-red lamp.

[2] Choose the type that contains the daily portion of multiple vitamins, essential minerals, and salts for an adult (I used Supradyn).

Preparation. Grind the fish into powder and mix it with the flour, the salt, and the pulverised pill. Beat the egg slightly and add a little to the dry components. You need to get a hard paste in order to be able to form a ball, then leave it to desiccate for about half an hour. When its consistency is suitable, grate it with a cheese grater onto a sheet of paper. You will get various sizes of granules. Spread the granules on the paper and leave them to dry for about a day. The dried granules keep their quality (= the ants like them) for about half a year at room temperature in a dark and ventilated place.

I have planned this diet to culture *Myrmica* colonies because it is essential for the *Myrmica* colonies to be fed with protein and sugar (Wardlaw et al. 1998). However, the Bhatkar diet (Bhatkar & Whitcomb 1970) – which is presumably the most popular artificial ant diet (see e.g. Hölldobler & Wilson 1990) – contains very little protein (Buschinger & Pfeifer 1988).

Prominent shoots are preferred: microhabitat preferences of *Maculinea alcon* ([Denis & Schiffermüller], 1775) in Northern Germany (Lycaenidae)

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Abstract. The egg deposition behaviour of the Alcon Blue, *Maculinea alcon* ([Denis & Schiffermüller], 1775), was investigated in summer 2002 on a military training area near Osnabrück (North Rhine-Westphalia, Northern Germany). The study aims to analyse oviposition patterns on the flowers of the host plant *Gentiana pneumonanthe* (Marsh Gentian) and microhabitat characteristics of the chosen shoots. All possible host plants and all eggshells of *M. alcon* were counted and various characteristics of the host plant as well as the surrounding vegetation structure were recorded. A total of 1,787 eggs was counted on 124 out of 219 *Gentiana* shoots in an area of 3,200 m². About 70% were laid on the calyx and 25% on the flower. The vegetation (*Juncus-Succisa pratensis* association with patches of *Ericion tetralicis*) was generally dense and rather high. Occupied specimens had almost always a luxuriant growth and were mostly higher than the surrounding vegetation. In a logistic regression model the height-difference between the plant and the vegetation (prominence), the number of flowers per shoot, and the number of further shoots in the surrounding explained 78% of observed plant occupancy patterns. Finally suggestions to maintain and stabilize Alcon Blue populations are given.

Zusammenfassung. Das Eiablageverhalten des Lungenenzian-Ameisenbläulings, *Maculinea alcon* ([Denis & Schiffermüller], 1775), wurde im Sommer 2002 auf einem Truppenübungsplatz in der Nähe von Osnabrück (Nordrhein-Westfalen, Norddeutschland) untersucht. Ziel der Arbeit war es, Eiablagemuster an den Blüten der Wirtspflanze *Gentiana pneumonanthe* (Lungenenzian) sowie Mikrohabitatpräferenzen bei der Belegung zu studieren. Dazu wurden alle Lungenenziansprosse und die Eier von *M. alcon* gezählt. Verschiedene Parameter der Wirtspflanzen sowie die Vegetationsstruktur im Umkreis von 50 cm wurden aufgenommen. Von insgesamt 219 Sprossen auf einer Fläche von 3.200 m² waren 125 mit 1.787 Eiern belegt. Etwa 70% davon wurden an den Kelch geheftet und 25% an die Blüte. Die Vegetation (*Juncus-Succisa pratensis*-Assoziation mit einzelnen *Ericion tetralicis*-Flecken) war meist sehr dicht und relativ hoch. Belegte Lungenenzian-Exemplare waren in der Regel üppig und überragten größtenteils die umgebende Vegetation. Ein Modell der logistischen Regression zeigt, dass mit Hilfe der Höhendifferenz zwischen Spross und Vegetation, der Zahl der Blüten und der Anzahl der umgebenden Lungenenzian-Sprosse 78% der Daten korrekt vorhergesagt werden. Abschließend werden Vorschläge zum Erhalt und zur Stabilisierung von Populationen des Lungenenzian-Ameisenbläulings gemacht.

Key words. Alcon Blue, egg deposition, *Gentiana pneumonanthe*, *Maculinea alcon*, Marsh Gentian, management, microhabitat preferences, Germany.

Introduction

Habitat quality has been shown to be as important for the persistence of butterfly metapopulations as the degree of patch isolation and patch size (Anthes et al. 2003; Dennis & Eales 1997; Thomas et al. 2001). Thomas et al. (2001) and WallisDeVries (2004) pointed out that the criteria are not alternatives but should be considered complementarily. While many studies have recently addressed the effect of patch size and isolation on population dynamics for various butterflies, habitat quality is still comparably ill-defined for many endangered species. Habitat preferences of butterflies are often largely determined by the requirements of the preimaginal stages since the eggs are not and the larvae are only slightly mobile (Fartmann 2004; Porter 1992). In case of adverse weather or restricted food supply they are not able to escape. Therefore, the evaluation of habitat quality for a particular species requires a detailed knowledge of the preferences of ovipositing females and the survival of preimaginal stages under various conditions and across regions.

Here we studied the larval habitat preference of the Alcon Blue (*Maculinea alcon* ([Denis & Schiffermüller], 1775)). Although the butterfly genus *Maculinea* van Eecke, 1915 has attracted considerable attention because of its extraordinary relationship with ants of the genus *Myrmica* Latreille, 1804 (Munguira & Martin 1999; Als et al. 2004), recent descriptions of larval habitat requirements are scarce. The status of the Alcon Blue has been assessed as vulnerable in Europe (van Swaay & Warren 1999) and as endangered in Germany (Pretscher 1998); in North Rhine-Westphalia the species is critically endangered (Dudler et al. 1999). In many parts of Germany it is extinct (Fig. 1). Whereas quite a lot of research has addressed the relationship between *M. alcon* larvae and their host ants (e.g. Als et al. 2001; Elfferich 1988; Elmes et al. 1994; Liebig 1989; van Dyck et al. 2000), the relationship between *M. alcon* and its host plant *Gentiana pneumonanthe* (Marsh Gentian) is much less studied. Krismann (2000) studied oviposition patterns on the host plant and found a preference for egg-laying on the calyx. WallisDeVries (2004) compared habitat characteristics of occupied and unoccupied sites at a mesoscale of 10 × 10 m. The preferred vegetation structure for egg deposition is mostly known for the sibling species *Maculinea rebeli* (Hirschke, 1904) (Dolek et al. 1998; Kockelke et al. 1994; Meyer-Hozak 2000) but not for *M. alcon*, yet Marktanner (1985) observed that it avoids dense and overshadowed vegetation. The status of both forms as distinct species is strongly questioned by the recent genetical data (Als et al. 2004).

This study aims to increase our knowledge of the microhabitat structure at *M. alcon* oviposition sites. In particular we considered the following questions:
(i) What are the oviposition patterns on the Marsh Gentian?
(ii) Which kind of vegetation structure does the Alcon Blue prefer for egg deposition?
(iii) Which conclusions can be drawn for the management of the Alcon Blue sites?

Material and Methods

Study species. *Maculinea alcon* ([Denis & Schiffermüller], 1775) has a scattered distribution across Europe up to East Asia (Wynhoff 1998). In Germany the Alcon Blue is mainly found on the foothills of the Alps and in the Northwestern Lowlands (Fig. 1). Its flight period in Germany extends from early July to mid-August (Ebert & Rennwald 1991; Wynhoff et al. 1999). *M. alcon* thrives on moist meadows, wet heathland and fens with stands of its host plant, the Marsh Gentian (*Gentiana pneumonanthe*). In the Alps the Willow Gentian (*G. asclepiadea*) is used as well. The Alcon Blue has a complex life cycle and is dependent not only on the presence of its host plant but also on the presence of host ants of the genus *Myrmica*. In Southern Europe and the pre-alpine region of Germany (Nunner pers. comm.) only *M. scabrinodis* Nylander, 1846 serves as a host. In Middle and Northern Europe it is fully replaced by *M. rubra* (Linnaeus, 1758) and *M. ruginodis* Nylander, 1846 (Elmes et al. 1998). Females of *M. alcon* lay their eggs on the buds of *G. pneumonanthe*. Through basal hatching the larvae get into the flower and feed there until the fourth larval stage. After emerging from the flower head they let themselves drop on the ground and wait to be carried into

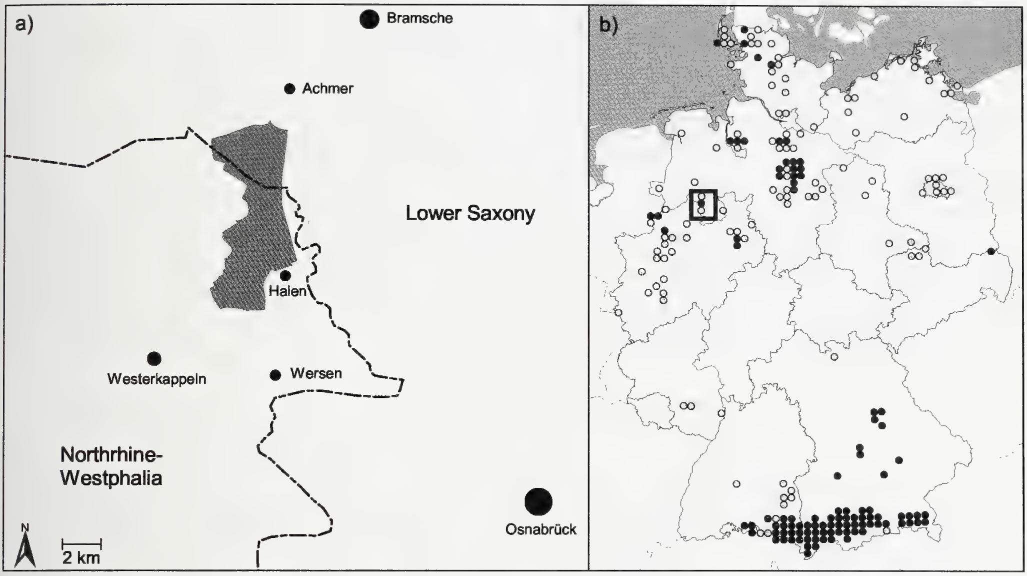


Fig. 1. Study area in Northern Germany (a) and distribution of *Maculinea alcon* in Germany (b). Grid: 10' × 6' geographic grid. Grey dots: data before 1985, black dots: data since 1985, data from: BLfU (2001), de Lattin (1957), Ebert & Rennwald (1991), Habel (2003), Harkort (1975), Kinkler & Schmitz (1971), Kolligs (2003), natural history museum Muenster (own observation), Retzlaff (1973), Retzlaff et al. (1993), Stamm (1981), Wagener & Niemeyer (2003) and M. Goldschalt, H. G. Joger, A. Krismann, A. Nunner, T. Marktanner, R. Reinhardt, T. Schulte (in each case pers. comm.).

a nest of their host ant where they live 10 to 22 months until pupation (Schönrogge et al. 2000; Thomas et al. 1998).

G. pneumonanthe (Gentianaceae) is distributed throughout Europe and Asia and has its core range in Western Europe (Korneck et al. 1998). The perennial plant flowers between July and September on oligotrophic humid sites such as litter meadows ('Streuwiesen') and moist to wet heathland (Oberdorfer 2001; Sebald et al. 1996). The light-requiring *G. pneumonanthe* grows up to 50 cm high with up to 10 shoots and up to 25 flowers per shoot (Ellenberg 1996; Rose et al. 1998). The reproduction only takes place by the means of its small seeds, which are adapted to short distance wind dispersal (Oostermeijer et al. 1998). For successful germination the seeds require moist and bare soil (Kesel & Urban 1999).

In Central Europe and in Germany *G. pneumonanthe* is declining. This is due to an intensified agricultural use on one hand. On the other hand the abandonment of smaller unprofitable habitats supports the succession on these sites. Both factors endanger the survival of the Marsh Gentian.

Study area. The study area is located in the district Steinfurt in the north of North Rhine-Westphalia adjacent to Lower Saxony (Fig. 1). The study site is part of a military training area. The vegetation is dominated by wet grasslands (*Molinietalia*) with some patches of *Agrostietalia* and *Nardo-Callunetea*. *Gentiana pneumonanthe* was growing within two sites (7,500 m^2 and 15,000 m^2) of the study area, but only on the bigger site *Maculinea alcon* was present in 2002. This place was surrounded by wood and consisted of the dominating *Juncus-Succisa pratensis* association with patches of *Ericion tetralicis*. Within this site the host plant grew on an area of about 3,200 m^2.

Tab. 1. Habitat structure parameters at occupied (n = 124) and unoccupied (n = 95) *Gentiana pneumonanthe* shoots (Mann-Whitney *U* Test: *** P <0.001, * P <0.05). *n G. pneumonanthe*: number of other shoots near the observed specimen; prominence: gentian shoot height minus average vegetation height.

Parameter	**Minimum – Maximum**		**Median**		**U**	**P**
	occupied	unoccupied	occupied	unoccupied		
Flowers per shoot	1–14	1–10	4	2	2847	***
Shoot height [cm]	22–60	22–51	39	35	3784	***
Average vegetation height [cm]	25–55	25–55	45	50	3397	***
Prominence [cm]	-29–20	-30–6	-3.4	-15	2030	***
n *Gentiana pneumonanthe*	0–13	0–11	5	4	4981	*
Horizontal herbaceous cover [%] in 30 cm	0–95	2.5–95	10	50	3751	***

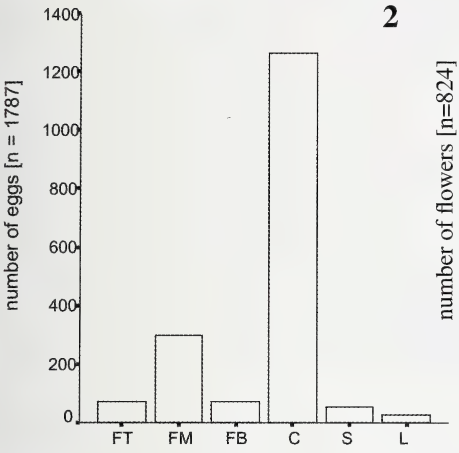
Field Study. In summer 2002 after the flight period of *Maculinea alcon* all shoots of *Gentiana pneumonanthe* were checked for eggs. For each gentian shoot we determined total height, the number of flowers and the height of each flower. The eggshells were counted bud-wise distinguishing between top, middle and base of flower, calyx, leave and stalk. For microhabitat analysis the following parameters were collected within a radius of 50 cm around the shoot: distance to the next shoot, number of other shoots, the maximum and average vegetation height, the vegetation cover and horizontal vegetation cover in 10 to 45 cm height above soil surface (estimated in 5%-steps). A grid of 10 × 10 m was put on the study site to determine these parameters also on a bigger scale. For data analysis we calculated the difference of the shoot height and average vegetation height to show the 'prominence' of the host plant. Negative values express a negative prominence, which means the shoot is smaller than the surrounding vegetation. Positive values show accordingly a positive prominence of the gentian shoot.

Data Analysis. Literature data showed that a single *Maculinea alcon* female lays on the average 50–100 eggs (Maes et al. 2004). Meyer-Hozak (2000) found out that the sibling species *Maculinea rebeli* lays 100–150 eggs per female. The primary sex ratio in a population is 1 : 1 (for *M. rebeli*: Kockelke et al. 1994; Meyer-Hozak 2000). We therefore used the total egg count from this study to estimate the adult population size in 2002.

To assess the explanatory power of different variables on the occupancy of gentian shoots we used a stepwise-forward logistic regression. All statistical analysis was performed with SPSS 11.0.1 statistical analysis package.

Results

We found a total of 219 Marsh Gentian shoots with 824 flowers. Of those, 124 shoots (57%) and 473 flowers (57%) were occupied with 1,787 eggs. Based on the total egg count the adult population size was estimated at 18–36 individuals. The preferred place of oviposition was the calyx in 70% of the cases, followed by the flower with 25%. The stem and the leaves played a minor role in egg deposition (Fig. 2). The height distribution of the eggs and the flowers were quite similar. About 2/3 of both flowers and eggs were found at 26 to 40 cm above ground (Fig. 3).



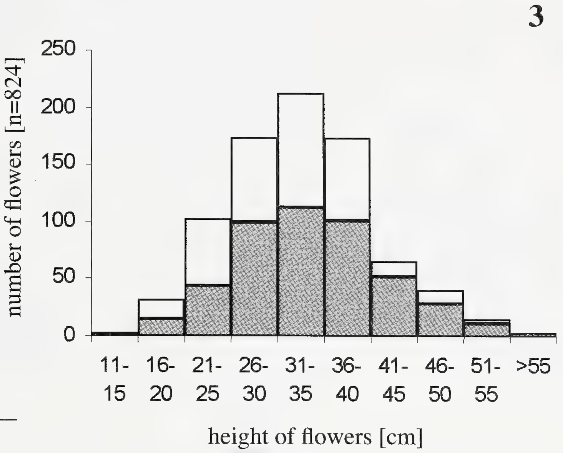


Fig. 2. Oviposition places on *Gentiana pneumonanthe* (FT = flower top, FM = flower middle, FB = flower base, C = calyx, S = stalk, L = leave).

Fig. 3. Height of occupied (grey) and unoccupied (white) flowers of *Gentiana pneumonanthe*.

The vegetation at the egg-deposition places was relatively high and dense. Maximum vegetation height ranged from 80 to 100 cm. Vegetation cover was mostly 100%, only in some cases it was with 80–95% slightly less dense. The Marsh Gentians were scattered over the whole site but had a clustered occurrence in some places especially along old tank tracks. Most part of the study site was dominated by the Purple Moor Grass (*Molinia caerulea*) and was characterized by a vivid change of hummocks and hollows. Only some gentian shoots were found on a drier and more even area, which was dominated by the Tufted Hair-grass (*Deschampsia cespitosa*).

Occupied gentians were generally higher and had more flowers than unoccupied specimen. High average vegetation height and low horizontal vegetation cover decreased the likelihood of a host plant to be accepted for oviposition (Tab. 1). Most occupied stalks were higher or only little lower than the average vegetation (Fig. 4). The more prominent a shoot the more eggs it received (Fig. 5).

The distribution of occupied and unoccupied Marsh Gentian shoots was best explained by the combination of height difference (prominence), number of flowers per stalk and number of other Marsh Gentian shoots in the proximity. The logistic regression model classified 78% of the data correctly by means of these three parameters (Tab. 2).

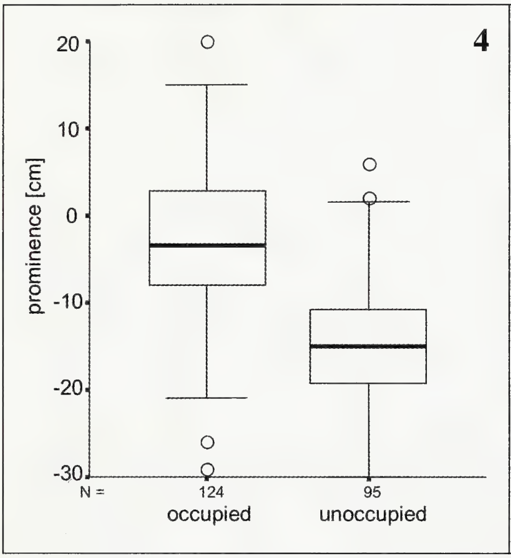
The hatched grids in Fig. 6 show the average height difference. The more prominent the gentian shoots were the more likely they were to be chosen for oviposition.

Discussion

Microclimatic aspects play an important role in butterfly oviposition (Fartmann 2004; Porter 1992; Thomas et al. 1998). As all gentians grew in sunny areas they were theoretically equally available for egg deposition. However, only about half of the shoots were occupied with eggs. Not only the size of the plant and the number of flowers,

Tab. 2. Stepwise-forward logistic regression model on the influence of habitat structure parameters on the egg deposition preference of *Maculinea alcon* (host plant shoots n = 219). n.s. = not significant; n *Gentiana pneumonanthe*: number of other shoots near the observed specimen; prominence: gentian shoot height minus average vegetation height.

Parameter	Coefficient B	SD	P	R	Model improvement Chi²
Constant	-0.027	0.497	n.s.	·	.
Prominence [cm]	0.143	0.025	<0.001	0.326	76.49
Flowers per shoot	0.263	0.089	<0.005	0.150	10.83
n *Gentiana pneumonanthe*	0.139	0.052	<0.05	0.132	7.78
Shoot height [cm]	0.657	-	n.s.	0.000	.
Average vegetation height [cm]	0.657	-	n.s.	0.000	.
Horizontal herb cover [%]	0.159	-	n.s.	0.000	.
Model summary	$Chi^2 = 95.1$, df = 3, P <0.001				
Correctly classified	78.1%				



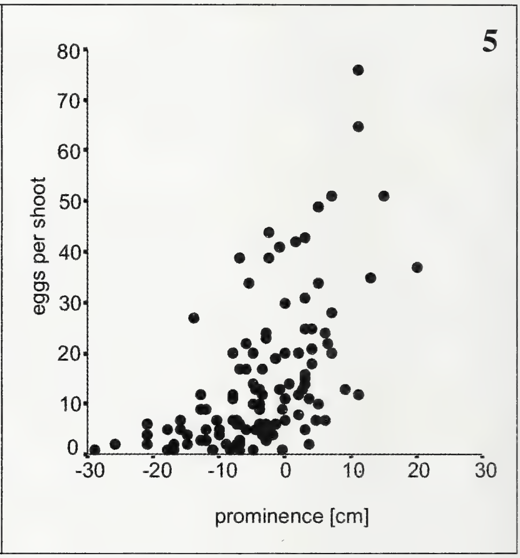


Fig. 4. Difference of hostplant height and average vegetation height (prominence) of occupied and unoccupied *Gentiana pneumonanthe* shoots (Mann-Whitney *U* Test: U = 2030, P <0.001). Compare Tab. 1 for statistics.

Fig. 5. Number of eggs per *Gentiana pneumonanthe* shoot in relation to the prominence (host plant shoots n = 124). $r_s = 0.622$, n = 124, P <0.01. Prominence: gentian shoot height minus average vegetation height.

but especially the shoot height relative to the height of the surrounding vegetation are important. Results of the logistic regression model show that the preferred oviposition places are shoots with many flowers that protrude the vegetation and are surrounded by other *Gentiana* shoots.

It is a common phenomenon that females choose large and conspicuous host plant individuals (Porter 1992). *Maculinea rebeli* prefers luxuriant specimens of its host plant *Gentiana cruciata* that are easy to reach (Dolek et al. 1998; Meyer-Hozak 2000). First, visual attraction is an important factor when searching for a suitable host plant

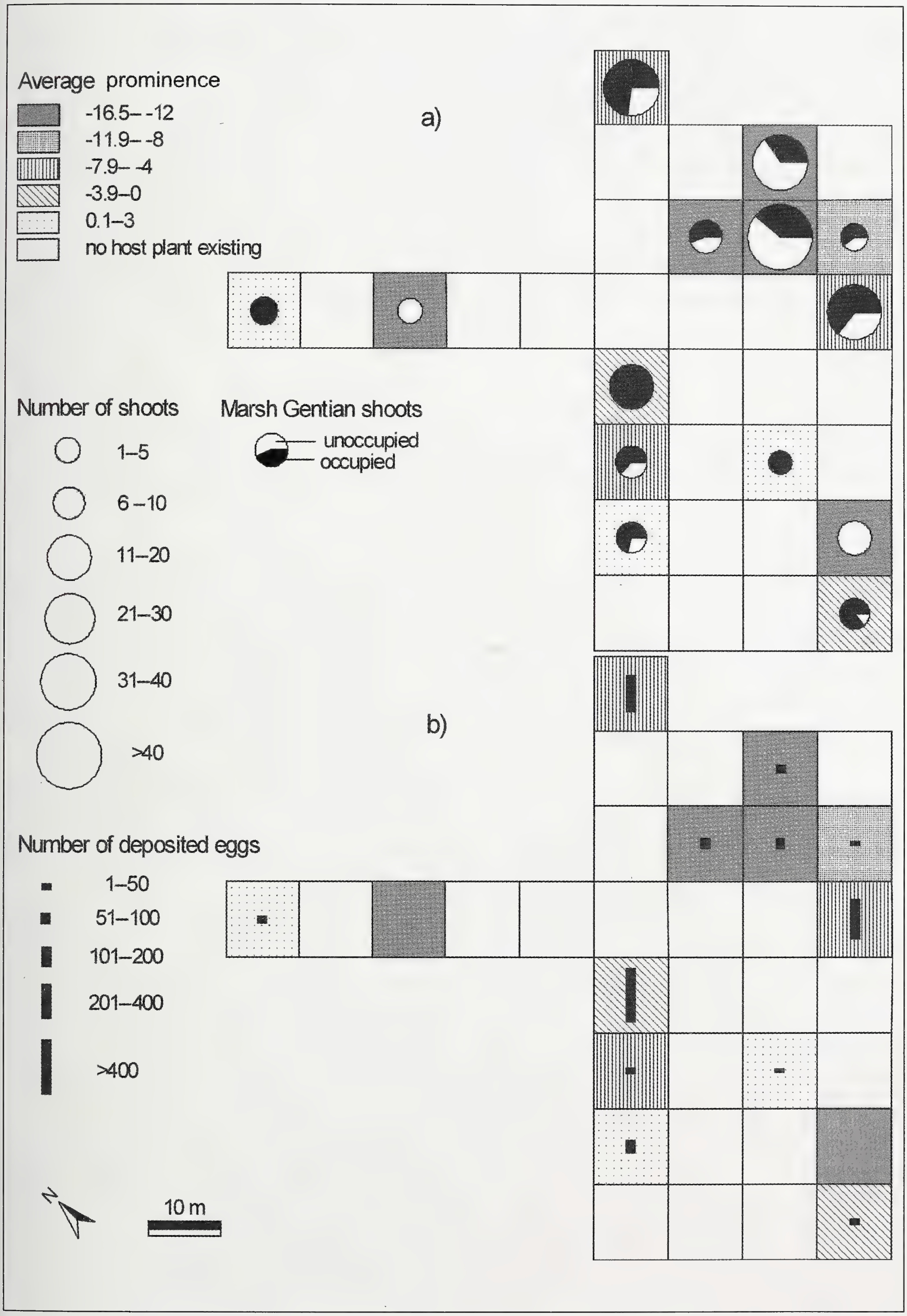


Fig. 6. Occupied and unoccupied Marsh Gentian shoots (a) and number of deposited eggs (b) per grid in relation to promincence. The average prominence is the median of all recorded height differences per grid.

(Dolek et al. 1998). Prominent shoots can be seen easily and are hence predestined as oviposition site. Second, shoots that grow higher than their surrounding vegetation are less shaded and offer better microclimatic conditions for a quick development of eggs and larvae. Besides it is risky to lay eggs on gentians hidden in dense vegetation because of the orb-web spiders, which are common in unmown meadows in this time of the year (Nunner pers. comm.). Third, bigger gentians may produce bigger buds and therefore offer more food resources for the larvae.

Over occupation of the shoots is seldom. Only 10 out of 124 shoots had more than 6 eggs per flower. About 4 to 6 *Maculinea alcon* larvae can feed on one flower (Elmes & Thomas 1987; Ebert & Rennwald 1991), which means that for almost all larvae there are sufficient food resources.

Despite the impression that the striking white eggs of *M. alcon* are mainly laid on the blue flowers of *Gentiana pneumonanthe*, we found almost three quarters of the eggs on the calyx but only one quarter on the flower. On the foothills of the Alps, Krismann (2000) found a similar distribution pattern on both *G. pneumonanthe* and *G. asclepiadea*. This oviposition pattern makes sense taking into account that the larvae of *M. alcon* leave the eggs through basal hatching (Thomas et al. 1991). They bore through the calyx and directly move to their food resource, the plant ovary.

Since *M. alcon* larvae hatch rapidly, the strong exposition of the eggs might be contributing to a fast larval development (Porter 1992). Within 3–4 weeks the larvae have to reach the fourth larval instar and need therefore optimal microclimatic conditions such as on the concealed flowers are provided. Although the eggs are more or less unprotected and very conspicuous, they are rarely parasitised. This may be due to the thick eggshells, which effectively prevent perforation by parasitoid wasps (Thomas et al. 1991). Thick eggshells may further protect against bad or hot weather.

The study site lies fallow; there is no regular utilization or care. Therefore it is dominated by the Purple Moor Grass (*Molinia caerulea*). Vegetation cover was mostly 100%. Nevertheless the Marsh Gentian is able to survive in such dense vegetation because of its longevity (Rose et al. 1998). On the study site mostly adult *G. pneumonanthe* grow. Oostermeijer et al. (1994) call this population type 'senile'. However, a senile population provides advantage for *M. alcon* regarding the suitability of egg deposition as most of the plants are relatively high and mostly covered with several flowers. This is reflected in the proportion of occupied gentians, which was with over 50% very high (compare Habel 2003; Krismann 2000). Still for a long-term survival of the gentian population and also of the Alcon Blue population a rejuvenation of the host plants is necessary which means creating gaps of bare soil.

There are different ways to assure the regeneration of *G. pneumonanthe* populations. Kesel & Urban (2000) and WallisDeVries (2004) suggest that small-scale sod cutting is best to promote existing gentian populations. Gaps are created in which the seeds can germinate and the young seedlings can grow protected. Though mowing is probably the better alternative to prevent from floristic impoverishment, to keep the vegetation open and to support the growth of accessible gentian shoots (Nunner pers. comm.). The best time is in October when the gentian seeds are mature and the *M. alcon* larvae are adopted (Briemle & Ellenberg 1994; Nunner pers. comm.). The hay should be taken away to prevent litter accumulation (Fartmann & Mattes 1997). Trautner et al. (2004) and WallisDeVries (2004) suggest that extensive grazing is also appropriate as management for *M. alcon* habitats with *G. pneumonanthe* as host plant. The gentian plants grow less luxurious but the small flowers seem to offer enough food for the *Maculinea* larvae until adoption. However, grazing is not an alternative when *G. pneumonanthe* sites are small because of the risk of local overgrazing or when *G. asclepiadea* is the host plant because it is more sensitive to browsing.

As most Marsh Gentian plants on the study site grow along old tank tracks it may be supposed that occasional mechanic disturbance through tanks or other means can have positive effects if it happens only every couple of years.

Acknowledgements

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A new subspecies of *Pelatea klugiana* (Freyer, 1836) from the Middle Volga Region of Russia with notes on its morphology and life history (Tortricidae)

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Abstract. *Pelatea klugiana verucha* ssp. n. is described from the Middle Volga Region of Russia within the limits of the southern Uljanovsk Province. Data on its life history and morphology of the preimaginal stages are given. The species is noted from Russia for the first time.

Zusammenfassung. Eine neue Unterart, *Pelatea klugiana verucha* ssp. n., wird aus dem südlichem Teil des Uljanowsk-Gebietes in Russland beschrieben. Bemerkungen zur Lebensweise sowie zur Raupen- und Puppenmorphologie werden gegeben. Die Art wird erstmals für Russland gemeldet.

Резюме. Новый подвид листовертки пионовой, *Pelatea klugiana verucha* ssp. n., описывается из южных районов Ульяновской области России. Приведены данные по его биологии и морфологии гусеничной и куколочной стадий. Вид впервые отмечается с территории России. Голотип нового таксона хранится в коллекции Зоологического института Российской Академии Наук (г. Санкт-Петербург).

Key words. Lepidoptera, Tortricidae, *Pelatea,* Russia, new subspecies, biology, larval and pupal morphology.

Introduction

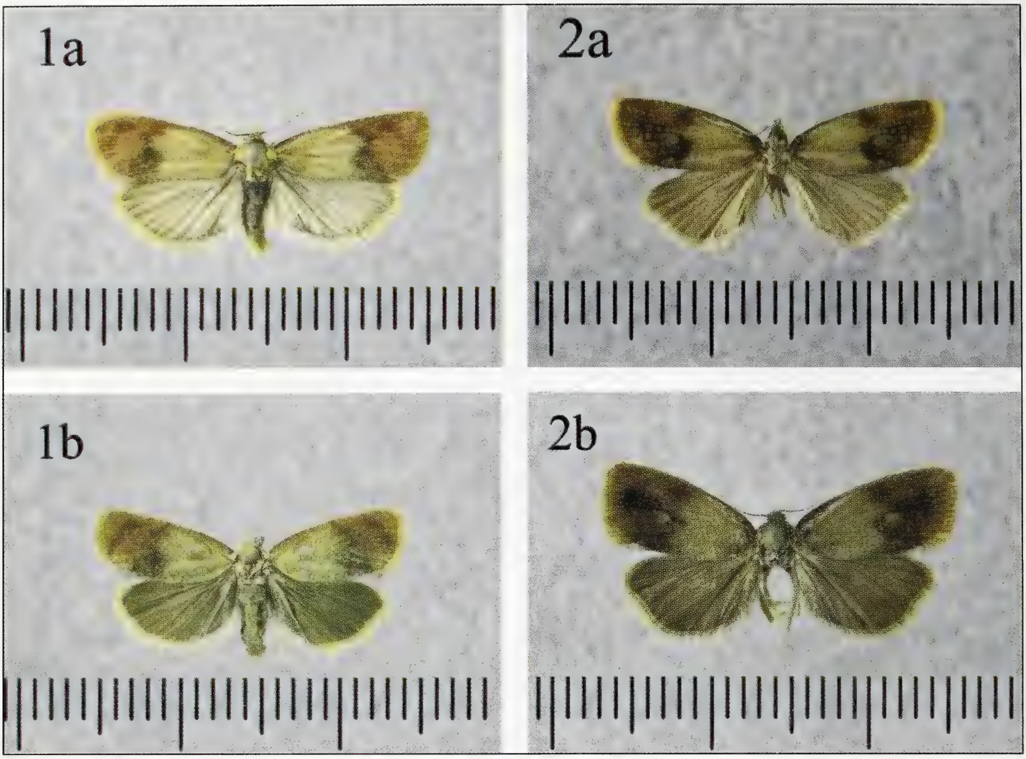
A large sample of a tortricid moth has been reared from *Paeonia tenuifolia* during expeditionary trips 1996–2003 through the right bank of the middle Volga Region (south of the Uljanovsk Province). Firstly, the species has been identified as *Pelatea klugiana* (Freyer, 1836) known within the limits of the former USSR only from the Carpathians (Kuznetsov 1978; Razowski 2001, 2003). Hence, subsequent comparison with material from the Alps has allowed to consider this population of the Russian plane in a rank of a separate subspecies. Its description is given below.

Abbreviations

EMEM	Entomological Museum of Dr. Ulf Eitschberger, Marktleuthen, Germany
SamGU	Zoological Museum of the Samara State University, Samara, Russia
SarGU	Zoological Museum of the Saratov State University, Saratov, Russia
UlGPU	Zoological Museum of the Uljanovsk State Pedagogical University, Uljanovsk, Russia
ZISP	Zoological Institute of the Russian Academy of Sciences, St. Petersburg, Russia
ZMHUB	Zoological Museum of the Humboldt University, Berlin, Germany

Pelatea klugiana verucha ssp. n.

Material. Holotype ♂, **Russia**, Middle Volga Region, 140 km S Uljanovsk, vill. Srednikovo outsc., Mt. Atmala, mixed forest on chalk hills, 27.vi.1996 (e. l., from *Paeonia tenuifolia*), Zolotuhin leg. (ZISP). – Paratypes: 15♂, 9♀ same data as holotype, but 26.–29.vi.1996 (e. l.) Zolotuhin leg. (UlGPU), 6 specimens, same data (ZISP, SamGU, SarGU); 1♂, 2♀ same data, but 17.–18.vi.2003 (e. l.), Nedoshivina leg. (UlGPU); 47♂, 19♀, Saratov prov., Khvalynsk distr., 5 km NW Novaja Jablonovka, Armejskye Mts., SW slope of hill forest-setppe, 29.–31.v.2004 (e. l., collected 19.v.2004), Anikin leg. (SarGU). Also as paratypes the following material is designated: 8 last instar larvae and 7 pupae preserved in 1:1 mixture of 80% ethanol and glycerine (ZISP, UlGPU).

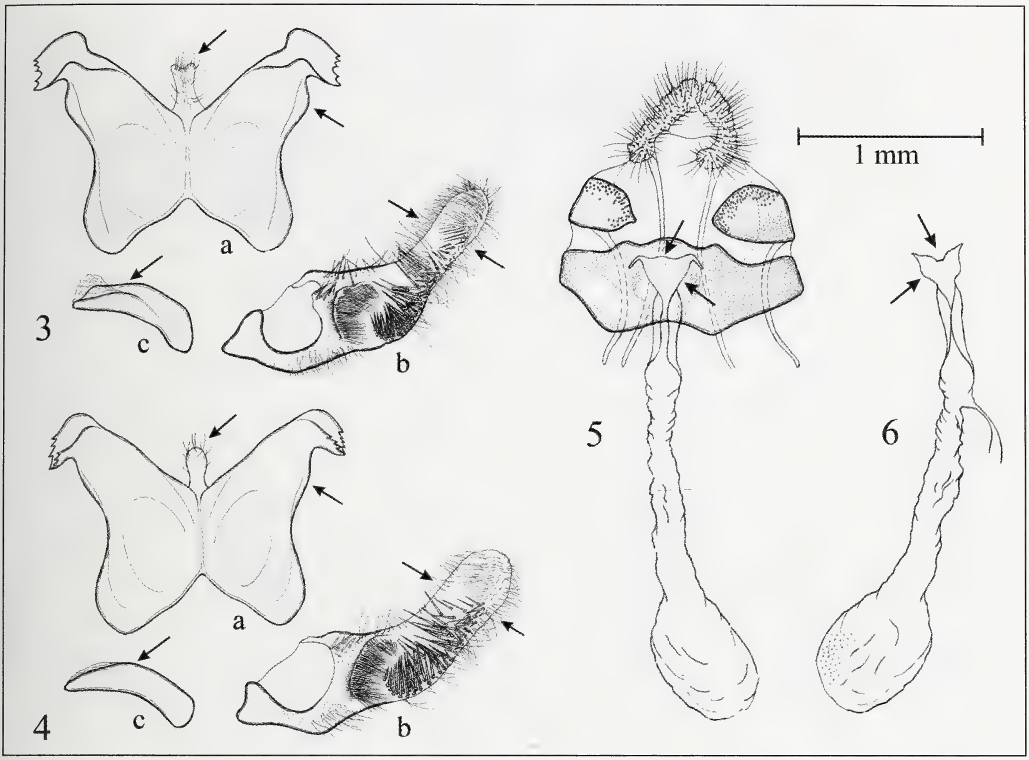


Figs. 1–2. Adults of *Pelatea klugiana*. **1.** *P. klugiana verucha* ssp. n., paratypes. **2.** *P. klugiana klugiana*, from South Tyrol. **a.** male. **b.** female.

Description (Fig. 1). Male. Forewing length 9.0–9.3 mm. Costal fold absent. Forewing light, brownish-olive with reddish-brown to pinkish outer half, crossing by vague silver net. Discal spot dark brown, often broaded to transversal band. Cilia light reddish-brown. Hind wings light, brownish olive with darker, narrow outer field. Cilia of the groundcolour. Body dark brown; tegulae with a tuft of reddish-yellow scales, metathorax with two reddish tufts; top of the abdomen with reddish-yellow hairs. Individual variation is observed in intensity of wing coloration from light brownish olive with pinkish spots to dark olive brown with dark pink spots but specimens with those extreme developed characters could be found rarely within large samples.

Female (Fig. 1b). With the same characters of pattern and coloration but somewhat larger (forewing length 9.2–9.5 mm) and more robust; silver net on the fore wings more vague; hind wings dark grey, without basal lightening, with light, brownish olive cilia.

Male genitalia (Fig. 3). As in the nominate subspecies. They are very remarkable at a whole and therefore outline clearly this genus from related genera. The new subspecies is characterized by slender cucullus and more compact groups of setae on its inner surface, more concave outer margin of lateral processes of tegumen, bilobed uncus and especially by the shape of the phallus having opening of vesica lateral. No cornuti are present.



Figs 3–6. Genitalia of *Pelatea klugiana*. **3.** *P. klugiana verucha* ssp. n., holotype ♂. **4.** *P. klugiana klugiana*, ♂; a – tegumen, b – valva, c – phallus. **5.** *P. klugiana verucha* ssp. n., paratype ♀. **6.** *P. klugiana klugiana*, ♀, internal parts.

Female genitalia (Fig. 5). As in the nominate subspecies and characterized by conical antrum as well as prominent margin of ostium. No distinct signa are visible but very vague sclerotization could be found on caudal part of bursa copulatrix.

Last instar larva (Figs. 7–9). 10 mm with maximal width 2.5 mm. Head and prothoracal shields black, well sclerotized, shining. Cuticula of the body weak and can be easily damaged just with tender pressure. Body pattern absent; coloration of subhypodermal type then the caterpillar is colored by haemolymph in dark green or malachite-green. Setae long, elastic, greyish.

Chaetotaxy (Fig. 7). Two D setae present on each segment. On T1 both are on the shield, on T2-T3 they are on the common pinacula, but on A1-A9 setae of D group are arranged each to separate pinacula. D1 is above D2 on T1-T2 and on A1-A8 but under of and anterior to D2 on T3. On A9, D2 is above D1, and situated on the separate pinacula closed to anal shield, as well as D1 is arranged to its own. SD1 and SD2 arranged to the shield on T1. On T2-T3 both are on the same pinacula, SD2 is above SD1. On other segments (except A9-A10), SD2 is minute and located anteriodorsal to the spiracle on A1-A7, but on A8 SD2 is anterior and SD1 is anteriodorsal to the spiracle. SD2 is absent on A9. SV group on T1 as well as on A1-A8, is bisetose. On other segments (except A10) it is unisetose. Three L setae on T1 are on common pinaculum. On T2, L1 and L2 share a pinaculum, and L3 is on its own. On T1, L1 is between L2 and L3, on T2-T3 L3 posteriodorsal to the others, L1 above L2. But on A1-A9, L3 posterioventral to others and L2 above L1; on A9, they all situated on a common pinacula. On all abdominal segments L group is also trisetose. V1 seta is presented on all segments. Proprioreceptor MD1 have relatively constant position anterioventral to D1 on all segments, except T1 and A10 where it is absent. MSD1 and MSD2 present only on T2-T3, where they arranged anterior to SD pinacula, MSD1 above MSD2. Chaetotaxy of the larval head as figured (Fig. 8).

Pupa (Figs. 10–12). Body length 7.0–10.5 mm. Coloration dark, yellowish brown. Frons flat and smooth. Proboscis extended to about one third of forewing length. Antenna extended more than two thirds of forewing length, and fore leg extended to about half of forewing length and mid leg somewhat longer. Forewing extended to posterior margin of 4th abdominal segment or ended slightly before. Veins distinct. Spiracles small, rounded oval. A2-A8 with two rows of dorsal spines. A1 and A9 with one cephalic row. Cremaster ventrally wrinkled, with lateral teeth. Cauda with 4 pairs of yellowish brown hooked setae. Anal rise with a pair of hooked setae on each side.

Diagnosis. Similar to the nominate subspecies but differs by smaller size (10.0–10.7 mm in the nominate subspecies), much lighter coloration and narrower wings. Silver net of forewing scales in the new subspecies much more vague. Diagnostic characters could be found also in genitalia. In the nominate subspecies the cucullus is broader, with less compact groups of setae on its inner surface, less concave outer margin of lateral processes of tegumen, unilobed uncus and dorsal opening of vesica as well as antrum is cup-shaped and margin of ostium is cut. Comparison with another species of the genus, *Pelatea assidua* Meyrick, 1914 from Taiwan, has not been possible because of absence of the material in European museums.

Distribution. Known only from the type locality – outskirts of Srednikovo vill. of the Uljanovsk Province (Fig. 18–19). Besides that, very characteristic damage of peonies by the caterpillars are known from Vjazovyj Gaj vill. (about 32 km to the south from the type locality). Without doubts, *Pelatea klugiana verucha* ssp. n. is connected closely in its distribution with the range of the food plant although is known not from all its populations (fig. 20). As a matter of fact, *Paeonia tenuifolia* grows in the Uljanovsk District exclusively on carbonat soils, mainly on chalk, in sparse forest-steppe associations and on stepped slopes (Maslennikov 1995). The range of the new subspecies is isolated geographically from the range of the nominated subspecies native to the mountain ranges of Central and Southern Europe.

Life history. Caterpillars of the species feed on different species of peonies. Foodplant in Central Europe – *Paeonia rosea* (Kuznetsov 1978; Razowski 2001, 2003) and small sample of moths reared from *P. officinalis* at our disposal from EMEM. In the Uljanovsk District caterpillars were collected from *P. tenuifolia*. Related species *P. biebersteiniana* with stronger and denser leaves is settled by the species not willingly. Larvae live in small colony from 2 to 5 specimens. They weave densely the growing buds of young sprout with silk thread forming some kind of silk nest. These dense nests are visible well on *Paeonia* bushes from afar (Fig. 13). Inside that, the caterpillars move on silk tunnels, feeding inside not coming on outer surface. Pupation within silk nest.

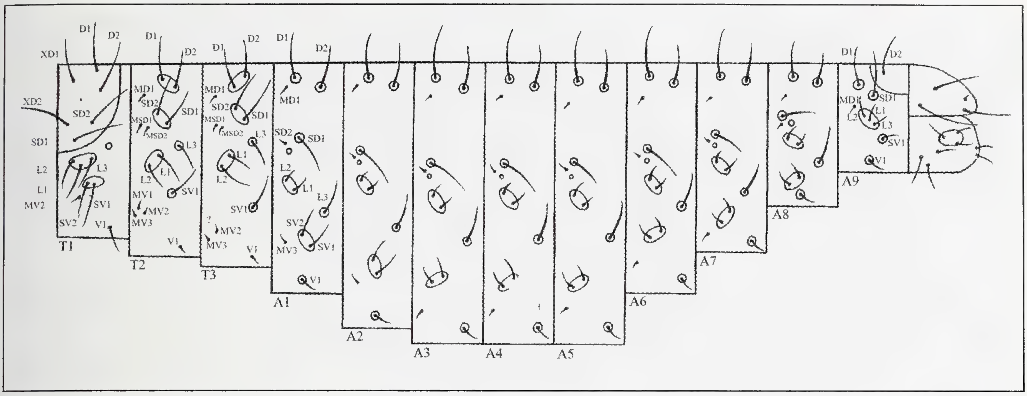


Fig. 7. Body chaetotaxy of the larva of *Pelatea klugiana verucha* ssp. n.

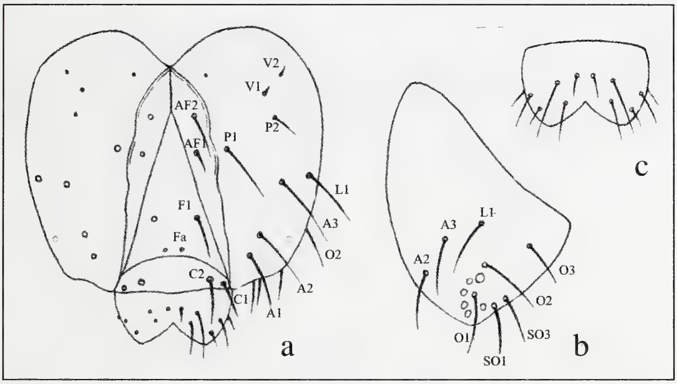
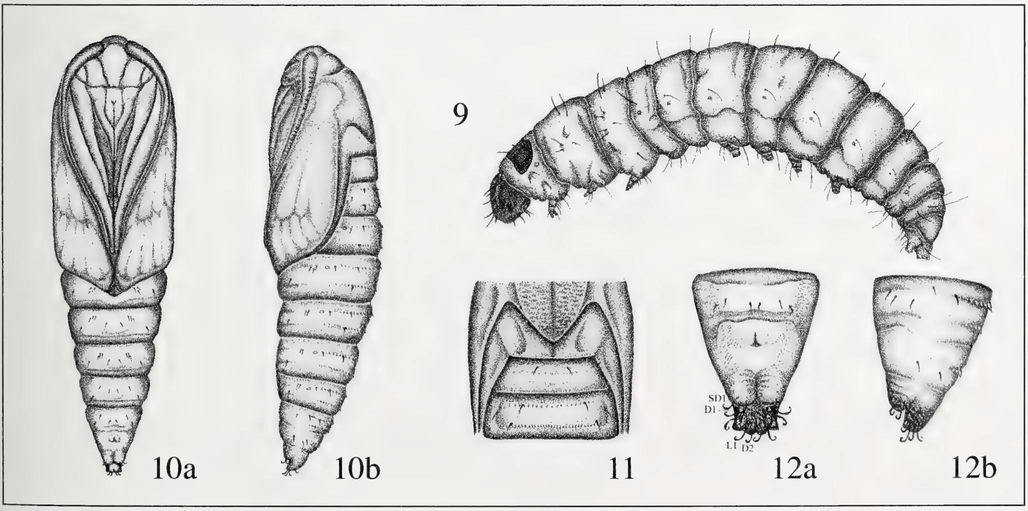
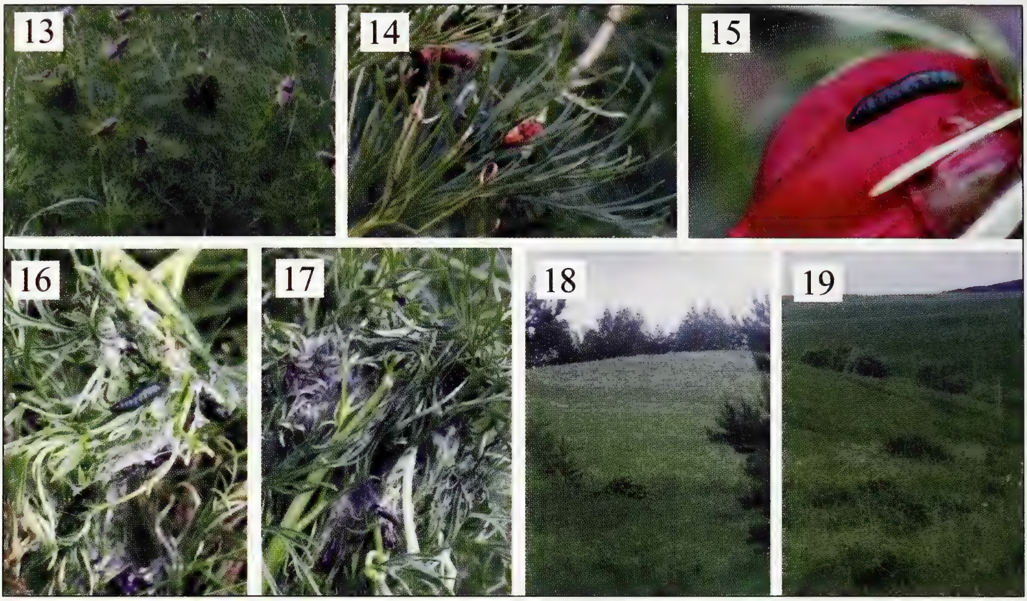


Fig. 8. Head chaetotaxy of the larva of *Pelatea klugiana verucha* ssp. n., **a.** frontal. **b.** lateral. **c.** labrum.



Figs. 9–12. Immature stages of *Pelatea klugiana verucha* ssp. n. **9.** Last instar larva. **10.** Pupa. **11.** metathorax and abdominal segments I–II of the pupa (dorsal view). **12.** Cremaster and abdominal segments VIII–X of the pupa. **a.** ventral. **b.** lateral.



Figs. 13–19. Life history of *Pelatea klugiana verucha* ssp. n. **13.** Silk nests forming by larvae on *Paeonia* bushes. **14.** Imago on the host plant. **15.** Larva. **16.** Larva inside the silk nest. **17.** Pupal exuviae in the silk nest. **18–19.** Type locality.

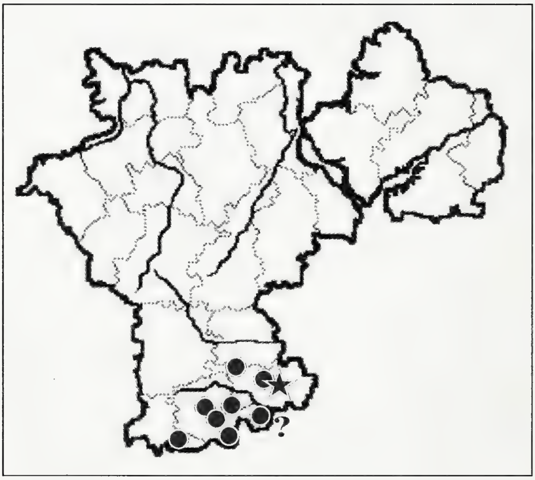


Fig. 20. Distribution of *Pelatea klugiana verucha* ssp. n. in the Uljanovsk Province. ● Locations of *Paeonia*. ★ Type locality of *Pelatea klugiana verucha* ssp. n. ? Unconfirmed occurrence of the moth-species.

Shortly before hatching (for 4–5 minutes), the pupa protrudes from the nest (Fig. 17). Emerging during all a day. Sex ratio males : females as 3:1 in first days and about 7:1 later. Moths are not mobile and only shortly flit being disturbed; they hold near by food plant and can be collected from it with the hand (Fig. 14). The subspecies has been not collected on artificial light. Flight period short (some days), and emerging from pupa is

synchronous, within 4–7 days. Develops one generation per year. Hibernating stage is unknown (egg, caterpillar within egg shell or young caterpillar?).
Some parasitoids were reared from the nests: *Temelucha* sp. (Ichneumonidae: Cremastinae), *Chelonus annulipes* Wsm. (Braconidae) as well as larvae of a very small unidentified tachinid fly, not developed into imago.

Comparative material examined of *Pelatea klugiana*: 1♂ **France**, Cannes Const.; 1♂ **Spain**, San Ildefonso, 84. m.; 1♂ Sierra de Alfacar, m., 89; 1♂ Granada m.; 1♂ Siera de Huetor, m. 80; 1♂ **Italy**, Carniolia; 2♀ Trentino, Mt. Baldo, Mt. Altissimo, 1450 m, ex Paeonia officinalis, 6. & 8.vi.1958, Jaeckh leg. (all ZMHUB); 2♂, 2♀ Mt. Baldo, late vi.1967 (e. l.), Pfister leg.; 3♂ Mt. Baldo, Corne Piana, 1600 m, late vi.1961 (e. l.), Burmann leg.; 7♂, 1♀ Mt. Baldo, mid vi.1958, Pfister leg. (all EMEM).

Derivatio nominis. The subspecies is named after Mrs Vera Isajeva (Uljanovsk, Russia) who took an active participation in collecting of entomological material and made a contribution to the knowledge of the entomofauna of the Uljanovsk District.
Remarks. The species is here recorded from Russia for the first time.

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We are grateful to Mrs V. Isajeva and Mr A. Isajev (Uljanovsk) for their help in many aspects. We want to thank Dr. V. I. Kuznetsov (St. Petersburg) for taxonomic advices, Dr. V. I. Tobias and Dr. R. Kasparjan (both St. Petersburg) who kindly identified the parasitoids. We also owe our special thanks to Dr. V. V. Anikin (Saratov) for his contribution to a knowledge of species biology in Saratov Province. And we thank Mr A. Noem for his help in technical work.

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Lithostege fissurata Mabille, 1888 from Malta, new for the fauna of Europe (Geometridae, Larentiinae)

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Abstract. The first record of *Lithostege fissurata* Mabille, 1888 for Malta Island and for the fauna of Europe is presented. *L. inanis* Prout, 1941 is downgraded (again) to subspecies of *L. fissurata*. *L. bifissana* Rebel, 1911 is downgraded from species rank to synonymy of *L. notata* Bang-Haas, 1906.

Zusammenfassung. *Lithostege fissurata* Mabille, 1888 wird für Malta und damit erstmals für die europäische Fauna nachgewiesen. *L. inanis* Prout, 1941 wird wieder auf den Rang einer Unterart von *L. fissurata* herabgestuft. *L. bifissana* Rebel, 1911 ist ein jüngeres Synonym von *L. notata* Bang-Haas, 1906.

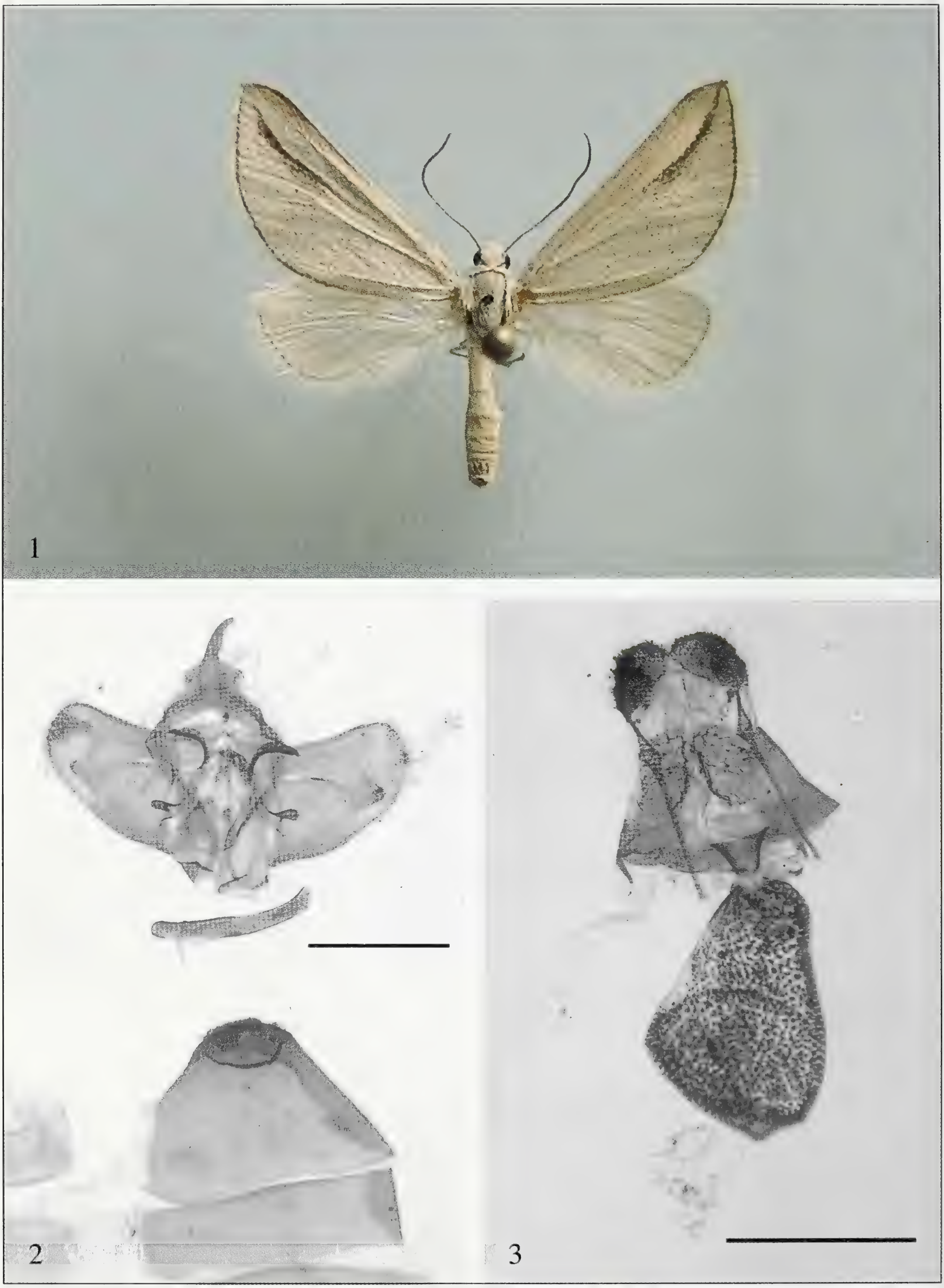
Key words. *Lithostege fissurata*, Geometridae, fauna of Europe, Malta, synonymy.

Introduction

When Müller (1996) listed 915 European geometrid species, the fauna was thought to be well known. However, during the preparation of the book series "The Geometrid moths of Europe", several new species were discovered. The new European checklist, which was published recently on the internet, contains 957 species (Hausmann 2004). The fauna of Malta included 52 geometrid moth species in Valletta (1973) and 57 species in Müller (1996). Sammut (2000) listed 89 geometrid species for the island, but many of these records are based on doubtful sources. According to Hausmann & Viidalepp (2004) there are 59 valid records while eight additional species await confirmation.

Eleven *Lithostege* species were mentioned by Hausmann & Viidalepp (2004). However, one of them, *L. cinerata* Turati, 1924 (sensu Hausmann 2004), has to be deleted because it was recently replaced by the description of *Lithostege clarae* Gastón & Redondo, 2004. The latter name was added to the faunal inventory 'at the last minute' (July 2004) and the name of the sister species could not be removed from the list. With the discovery of *L. fissurata*, the number of European *Lithostege* taxa increases to the following eleven species:

The *bosporaria* species-group
Lithostege bosporaria (Herrich-Schäffer, 1848)
The *farinata* species-group
Lithostege coassata (Hübner, 1825)
Lithostege farinata (Hufnagel, 1767)
Lithostege duponcheli Prout, 1938
Lithostege palaestinensis Amsel, 1935
Lithostege clarae Gastón & Redondo, 2004 (= *L. cinerata* sensu Hausmann & Viidalepp 2004)
Lithostege griseata ([Denis & Schiffermüller], 1775)
Lithostege fissurata Mabille, 1888
Lithostege infuscata (Eversmann, 1837)
Lithostege odessaria (Boisduval, 1848)
The *castiliaria* species-group
Lithostege castiliaria Staudinger, 1877



Figs. 1–3. *Lithostege fissurata* Mabille, 1888. **1.** Habitus of specimen from Malta (photo: A. Seguna). **2.** Male genitalia of specimen from Tunisia and sternum A8 (photos: A. Hausmann). **3.** Female genitalia of specimen from Tunisia (photo: A. Hausmann). Scale bars 1 mm.

Lithostege fissurata Mabille 1888 (Figs. 1–3)

Lithostege fissurata Mabille, 1888: 58 (type locality: Tunisia). Holotype ♀ (ZSM/Herbulot, examined; topotypical material of both sexes dissected: Figs. 2, 3).

Lithostege inanis Prout in Seitz, 1941: 331, "pl. 34i" (Scoble 1999), "pl. 34a" in the text of Prout (1941: 331), but not illustrated under both indications in the German edition of Seitz (type locality: Saudi Arabia: Khafa). Holotype ♂ (BMNH, examined; topotypical material of both sexes dissected). Wiltshire 1990 (synonym); Scoble 1999 (bona sp.); here regarded as subspecies of *L. fissurata* **stat. rev.**

Lithostege fitzgeraldi Wiltshire, 1947: 10, fig. 15, text-fig. 10 (type locality: Saudi Arabia, Artawiya, Nejd). Holotype ♂ (BMNH, examined). Scoble 1999 (junior synonym of *L. f. inanis*).

Material. 1♂, **Malta**, Qrendi, San Niklaw, 7.iii.2004, coll. Denis Magro, at light. Additionally examined (ZSM): 5♂♀ **Tunisia**, 11 ♂♀ **Algeria**, 1♂1♀ **Libya**, 4♂♂ S. **Israel** (Arava valley: Yotvata), 21♂♀ **Saudi Arabia**; 1♀ SE. **Iran** (Balutshistan).

Diagnosis. (Fig. 1). Wingspan: 19–28 mm. Wing shape with the generic characteristics of *Lithostege*, i.e. small, hindwing round, forewing termen convex, forewing apex slightly pointed. Ground colour of hindwing dirty white, that of forewing pale creame-coloured. No wing pattern except for the broad dark grey apical streak, which may, in about 5% of the specimens occasionally be absent or very weakly marked. In subsp. *inanis* this apical streak is always absent, hindwing darker than in nominate subspecies, usually darker than forewing. Sternum A8 in both sexes posteriorly sclerotised to a rounded lobe.

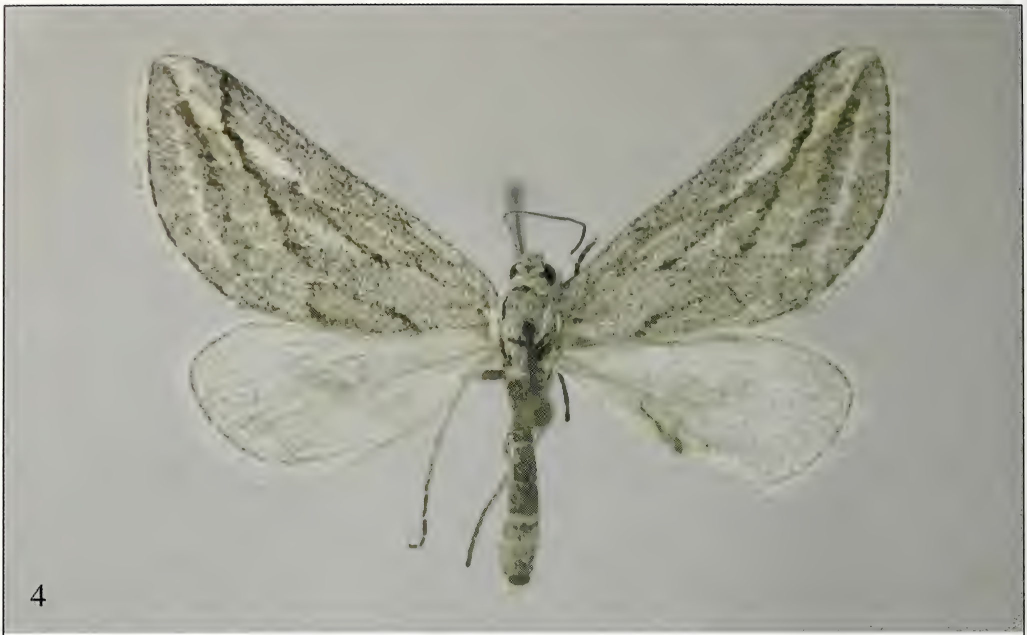
Male genitalia (Fig. 2). Uncus short, stout, tapered. Valva short and broad. Posterior basal process of valva short, strongly curved, spinulose at tip. Anterior basal process of valva short and rounded. Aedeagus short.

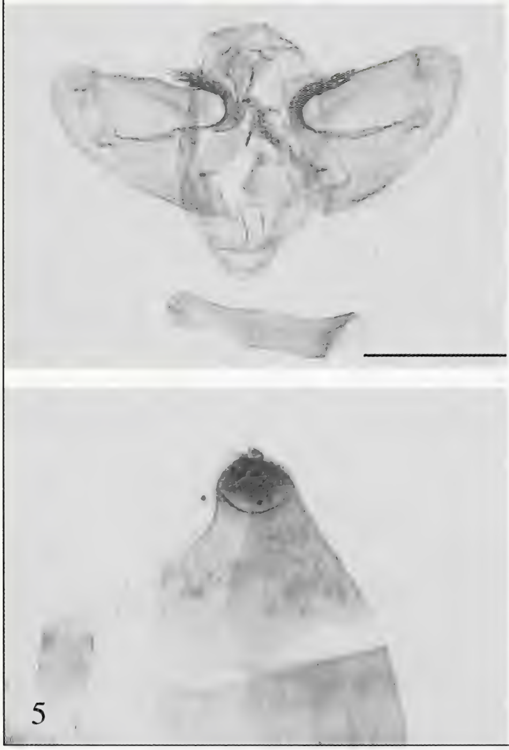
Female genitalia (Fig. 3). Apophyses anteriores very short. Antrum trapezoid or sub-triangular. Ductus bursae very short. Corpus bursae globular or slightly elongate, covered all over with spinules.

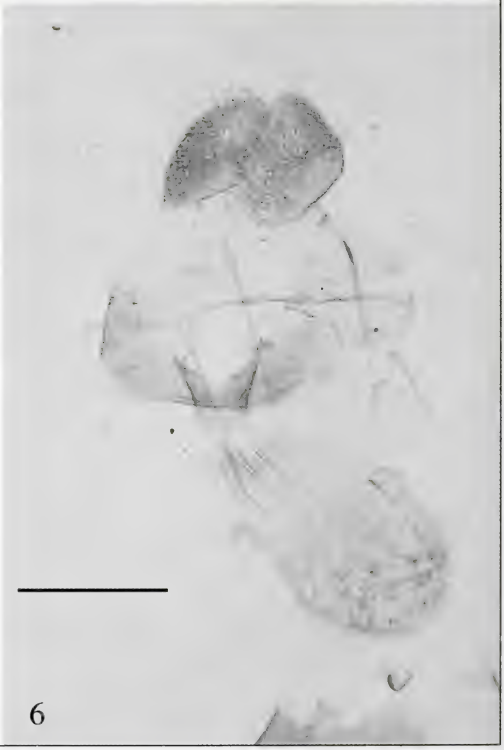
Distribution. Nominate subspecies from western Algeria to Libya, south-eastern Egypt (Wiltshire 1949), Israel (new for the fauna of Israel; Arava valley: ZSM). Subspecies *inanis* from Saudi Arabia to south-eastern Iran (new for the fauna of Iran; Balutshistan: ZSM) and southern Iraq (Wiltshire 1952).

Life history. Univoltine. Label data indicate a flight period spanning from early March to early May (nominate subspecies), and from mid-February to mid-March in ssp. *inanis*. Vertical distribution from 0 m up to 800 m above sea level. The moth was caught in Malta near a coastal steppe which includes plants like the Sea squill (*Urginea maritima*), Branched Asphodel (*Asphodelus aestivus*), and Spurges (*Euphorbia* spp.). Egg described in Prout (1937). Other immature stages unknown.

Remarks. After examination of numerous topotypical specimens exactly corresponding to the original description, the taxon "*L. bifissana* Rebel, 1911", described from the Jordan valley (Israel/Jordan) in comparison with *L. fissurata*, and treated as a separate species in Scoble (1999), must be downgraded to the synonymy of *L. notata* Bang-Haas, 1906 (syn. n.) (Figs. 4–6). The habitus and morphology of *L. fissurata* support its position in the *Lithostege farinata* species-group. The peculiar wing pattern excludes confusion with any other of the known *Lithostege* species, at least in the nominate







Figs. 4–6. *Lithostege notata* Bang-Haas, 1906 (=*bifissana* Rebel, 1911). **4.** Habitus of specimen from Jordan, 20 km NE Dead Sea. **5.** Male genitalia and sternum A8 (Israel, southern Dead Sea region). **6.** Female genitalia (Israel, southern Dead Sea region) (photos: A. Hausmann). Scale bars 1 mm.

subspecies. This new record shows that apart from new entries by 'species splitting', there are still some 'spectacular' Macrolepidoptera species awaiting discovery on the territory of Europe. However, it remains unclear whether *L. fissurata* is just a rare species, overlooked due to the early flight season, or a recent coloniser of the island of Malta, or a rare migrant from North Africa.

Acknowledgements

We are indebted to Denis Magro for the loan of the material in question.

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Revision of *Evergestis anartalis* (Staudinger, 1892) comb. rev. from Central Asia (Pyraloidea: Crambidae: Evergestinae)

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Abstract. The nomenclature of *Evergestis anartalis* (Staudinger, 1892) **comb. rev.**, a species which has been described three times and of which the names have been placed in three different subfamilies of Crambidae, is investigated. The generic name *Maelinoptera* Staudinger, 1893 **syn. n.** is revised as a junior subjective synonym of *Evergestis* Hübner, 1825 and the type-species of this monotypic genus, *Hercyna anartalis* Staudinger, 1892, is transferred to *Evergestis*. *Evergestis heliacalis* Zerny, 1914 **syn. n.** and *Noctuelia anartalis* Hampson, 1918 **syn. n.**, are considered as junior subjective synonyms of *Evergestis anartalis* (Staudinger, 1892) (*Hercyna*). *Evergestis anartalis* Hampson, 1918 (*Noctuelia*) therefore becomes a junior secondary homonym of *Evergestis anartalis* (Staudinger, 1892) (*Hercyna*). Lectotypes of *Hercyna anartalis* Staudinger, 1892 and *Evergestis heliacalis* Zerny, 1914 are designated. *Evergestis anartalis* (Staudinger, 1892) is redescribed; adults, male and female genitalia are illustrated. According to the specimens investigated, it is assumed that *Evergestis anartalis* is endemic to sub-alpine and alpine altitudes in Central Asia.

Key words. *Evergestis anartalis*, taxonomic revision, Central Asia, alpine altitudes, endemic species.

Introduction

After Staudinger (1892: pl. 3 fig. 17) already figured *Hercyna anartalis*, he provided the description of this species a year later and described the genus *Maelinoptera* to include *Hercyna anartalis* only (Staudinger 1893: 72–73). Already Meyrick (1890: 457–458), Rebel (1901: 56) and Zerny (1914: 326) included *anartalis* Staudinger in the genus *Evergestis* Hübner, 1825 but did not mention *Maelinoptera*. Subsequently, Klima (1939: 334) treated *Maelinoptera* as a synonym of *Evergestis*. However, *Maelinoptera* was later placed in Pyraustinae (Pyraloidea: Crambidae) by Fletcher & Nye (1984: 60), and the same authors distinguish the Evergestinae with the type genus *Evergestis* as a distinct group from Pyraustinae. The type series of *Hercyna anartalis* Staudinger is deposited at the Museum für Naturkunde in Berlin. However, a specimen looking externally conspecific with *anartalis* Staudinger and labelled as type of *anartalis* Hampson has been found also in the collection of The Natural History Museum in London (BMNH). Subsequent search in the card index of the BMNH referred to an original reference from which it is evident that Hampson (1918: 406–407) described a new species under the name *Noctuelia anartalis*. According to current classification, *Noctuelia* Guenée, 1854 belongs to the subfamily Odontiinae (Pyraloidea: Crambidae). Searching the literature, a further description has been detected of a species which seems to have affinities to *Hercyna anartalis* Staudinger, too. It is the description of *Evergestis heliacalis* by Zerny (1914: 326–327, pl. 26 fig. 26), which according to current classification belongs to Evergestinae. Thus, three species descriptions have been found in literature which are under the suspicion to belong to one species, or to a few closely related species, which however are assigned to three different subfamilies of Crambidae, depending on the reference used. Due to this confusing situation, the types of all three taxa, as well as additional specimens have been investigated and the results are presented in the following.

Abbreviations

BMNH	The Natural History Museum, London.
MTD	Museum für Tierkunde, Dresden.
NMW	Naturhistorisches Museum, Wien
SMF	Forschungsinstitut und Naturmuseum Senckenberg, Frankfurt am Main
ZMHB	Museum für Naturkunde der Humboldt-Universität zu Berlin

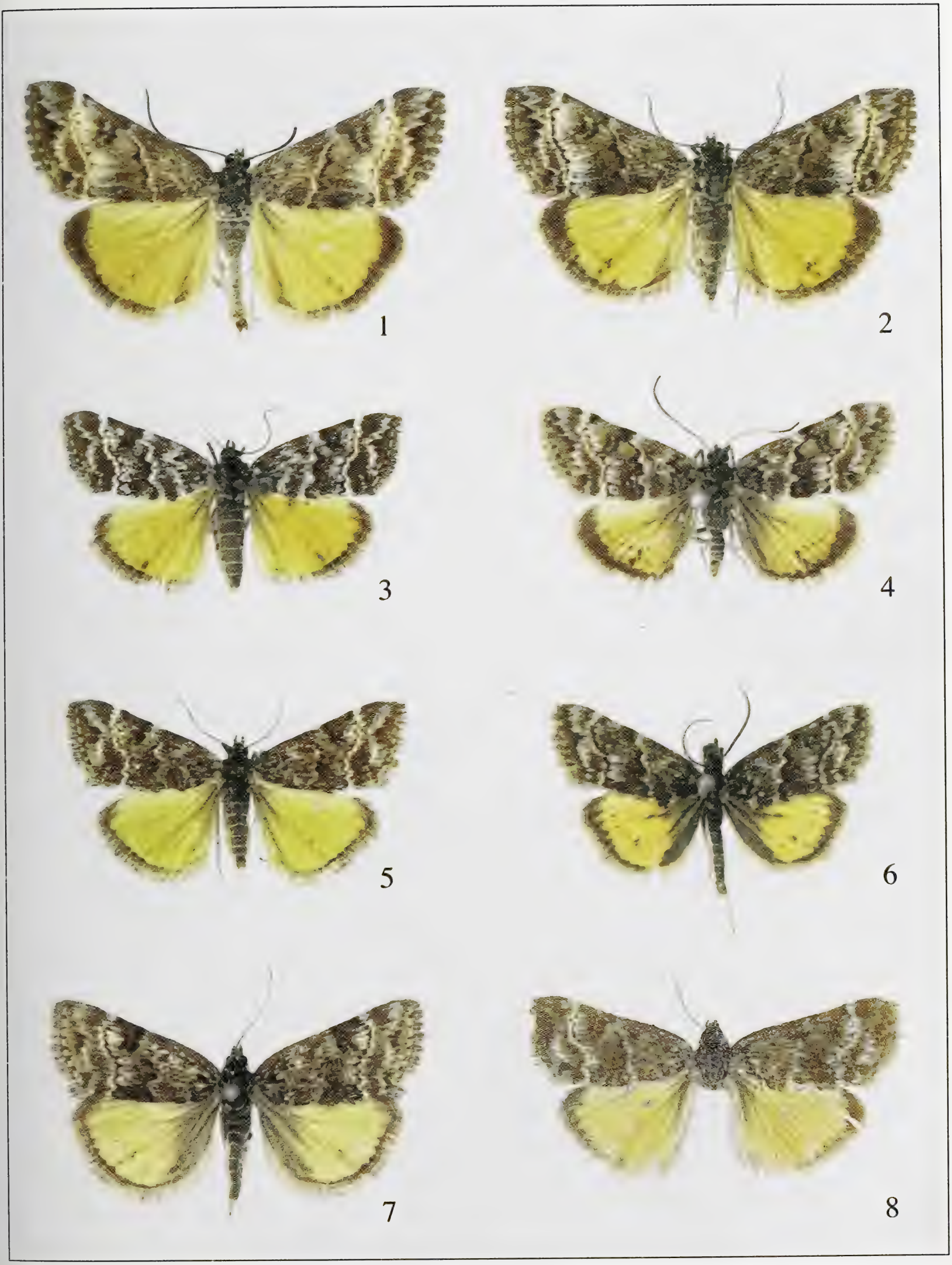
Evergestis anartalis (Staudinger, 1892) comb. rev.

Hercyna anartalis Staudinger, 1892: 466, pl. 3 fig. 17; 1893: 72 (type-locality: 'Centralasien').
Noctuelia anartalis Hampson, 1918: 406–407 (type-locality: 'E-Turkestan') **syn. n., junior secondary homonym**.
Evergestis heliacalis Zerny, 1914: 326–327, pl. 26 fig. 26 (type-locality: 'Djarkent Ili-Gebiet') **syn. n.**

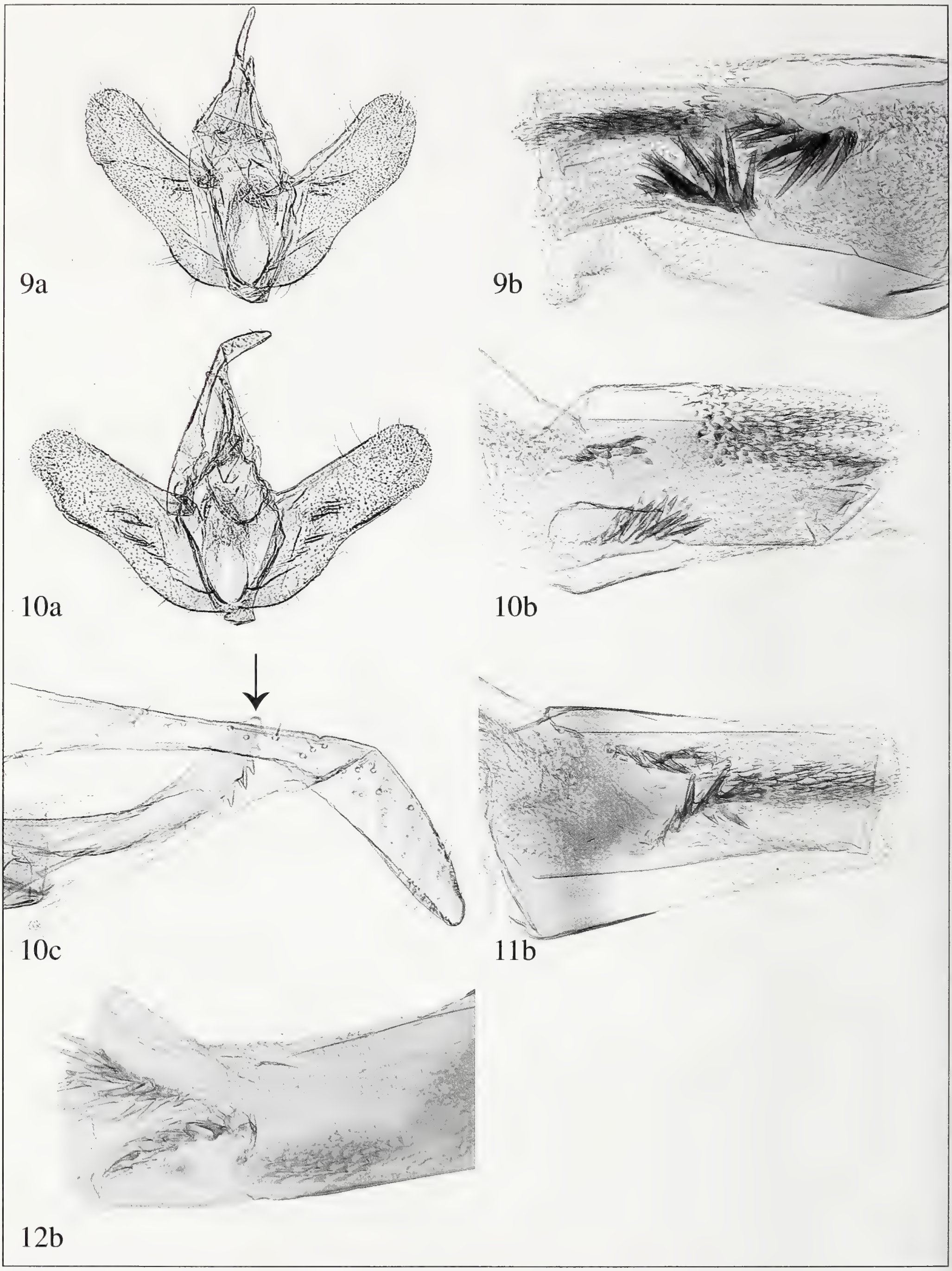
Material. *Hercyna anartalis* Staudinger: Lectotype ♂ 'Origin', [**Uzbekistan**, Namangan, 40°57'N 71°40'E], '*Hercyna anartalis* | Staudinger, 1892 | det & coll Stdgr 3#18 | teste M. Nuss, 1998', 'Lectotype | *Hercyna anartalis* | Staudinger, 1892 | des. M. Nuss, 2005' (hereby designated), 'prep. no. | 1040 | M. Nuss, 2005', ZMHB. – Paralectotypes: 3♂, 2♀, same data as lectotype; 1♀ Margelan [Alai, 40°24'N 71°43'E]; 1♀ **Kyrgyzstan**, Osch [40°29'N 72°51'E]; 1♂ Alexandergebirge (Kirgizskiy Khrebet, 42°30'N 73°30'E); 2♂, 2♀ **Kazakhstan**, Alatau [Dzungarischer Ala-Tau, 45°10'N 81°00'E]; 1♀ Kuldja [=Kuldsha, = **China**, Xinjiang, Gulja 43°57'N 81°24'E]; 1♂, 1♀ **Altai**; ZMHB. – *Noctuelia anartalis* Hampson: Holotype (by monotypy) ♀ 'Type', 'Turkestan | A. Avinoff. | 1913–191.', '*Noctuelia* | *anartalis* | type ♀. Hmpsn.', 'B.M. Pyralidae | Genitalia slide | No. 20282 ♀' (gen. prep. Nuss 828), BMNH. – *Evergestis heliacalis* Zerny: Lectotype ♂, with white label, printed: 'Asia centr. | [**Kazakhstan**] Ili Gebiet | Umg. Djarkent | Coll. Wagner', white label handwritten in black ink: '20.7.[19]10', white label handwritten in black ink: '*Evergestis* | *heliacalis* Zerny | ♂ [and in red ink:] Type', white label, printed: 'prep. no. | 1039 | M. Nuss, 2005' [prep. no. NMW: 16847], red label, printed: 'Lectotypus | *Evergestis heliacalis* | Zerny, 1914 | des. M. Nuss, 2005', (hereby designated), NMW. Paralectotypes: 2♀, same data, [but no date given], (one ♀ without abdomen), NMW. – Additional material. 1♂ **Kyrgyzstan**, Chatkal`skij Chrebet, Sarsuta Pass (41°31'N 70°46'E), 2800 m, 26.vi.1998, leg. et coll. Karisch; 1♂, 1♀ Turkestan Mts., Ak-Terek, Noo-Dzhailo valley, 3000–3400 m, 1.–14.vii.1999, Petrov leg., MTD; 1♂ Alayskiy Mts., Taldyikpass, 3550 m, 39°46'N 73°09'E, 13.vii.1998, Nuss leg., MTD; 2♂, 1♀ Alai, Paravicini Coll. B.M. 1937–383, BMNH. 1♂ **Kazakhstan**, Ili Gebiet, Djarkent (= Dzharkent, = Panfilov 44°10'N 80°01'E), coll. Möbius, MTD; 1♂ Zailijskij Alatau, Turgen valley, 43°15'N 77°52'E, 2400 m, 19.vi.2000, Nuss leg., MTD; 1♀ same data, but 2660 m; 3♂ Zailijskij Alatau, 43°05'N 77°04'E, 3300 m, 5.–6.vii.2000, Nuss leg., MTD. 2♀ **China**, Xinjiang, Korla, ZMHB; 1♂ Tura, coll. A. Seitz, SMF.

Description of the lectotype of *E. anartalis* (Staudinger), ♂ (Fig. 1).

Head. Globular; labial palpi porrect, as long as diameter of eyes, long and white scaled ventrally, light brown coloured laterally; maxillary palpi slender, cylindrical, upright; flagellum slenderly filiform, flagellomeres slightly prismatic, dorsally whitish brown scaled, ventrally densely setose. Head dorsally covered with spatulate scales, coloured brown, intermixed with white; ventrally predominantly white scaled; long hair-like scales are intermixed around the head, with the exception of compound eyes. Thorax. Dorsally dominantly covered with spatulate scales, coloured brown, black and white; intermixed with white hair-like scales. Ventrally predominantly scaled with white, hair-like scales, also at coxae and femora. Forewing 12 mm long, dorsal side dominant brown coloured; basal area with a white, dentate line proximal of antemedian line; antemedian line white, dentate, black edged towards median space; distal discocellular stigma X-like, black; postmedian line yellowish white, S-like bent from anterior to posterior margin of wing, proximally black edged and with broad cream-white band; at termen a white, strongly dentate line, black edged toward termen; fringe brown and white chequered. Hindwing dorsally dominant indian yellow coloured, with



Figs. 1–8. Adults of *Evergestis anartalis* (Staudinger, 1892). **1.** Lectotype, ♂, *Hercyna anartalis* Staudinger, 1892, from Namangan (ZMHB). **2.** Paralectotype, ♀, *Hercyna anartalis* Staudinger, 1892, from Namangan (ZMHB). **3.** Paralectotype, ♀, *Hercyna anartalis* Staudinger, 1892, from the Alay Mts. (ZMHB). **4.** Paralectotype, ♂, *Hercyna anartalis* Staudinger, 1892, from the Alexander Mts. (ZMHB). **5.** Paralectotype, ♀, *Hercyna anartalis* Staudinger, 1892, from the Alatau Mts. (ZMHB).**6.** Lectotype, ♂, *Evergestis heliacalis* Zerny, 1914 from Panfilov (NMW).**7.** Paralectotype, ♀, *Evergestis heliacalis* Zerny, 1914 from Panfilov (NMW). **8.** Holotype, ♀, *Noctuelia anartalis* Hampson, 1918 (BMNH).



Figs. 9–12. Male genitalia of *Evergestis anartalis* (Staudinger, 1892). **9.** Lectotype of *E. anartalis* (Staudinger), prep. Nuss 1040. **10.** Lectotype of *E. heliacalis* Zerny, prep. Nuss 1039. **11.** Paralectotype, *E. anartalis* Staudinger, prep. Nuss 1041 (same specimen as Fig. 4). **12.** Paralectotype, *E. anartalis* Staudinger from Namangan, prep. Nuss 831. **a.** male genitalia. **b.** posterior end of phallus with cornuti. **c.** distal tip of gnathos (arrow) and uncus.

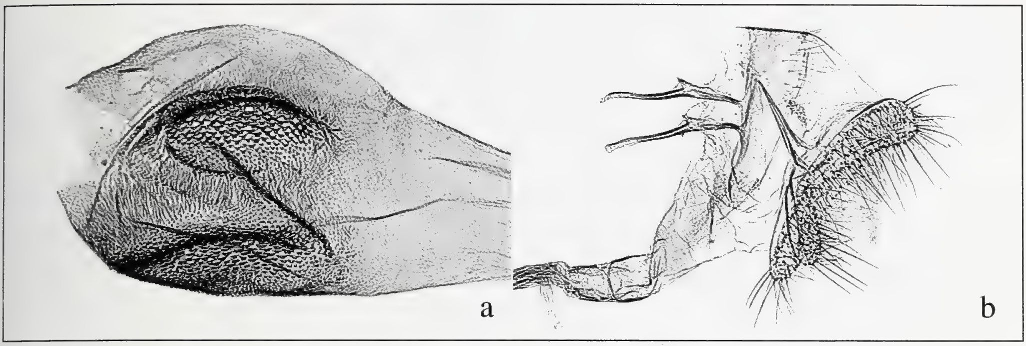


Fig. 13. Female genitalia of *Evergestis anartalis* (Staudinger, 1892), paralectotype from Alay Mts., prep. Nuss 829. **a.** bursa copulatrix. **b.** colliculum, segment VIII and papillae anales (from left to right).

dark brown margin; fringe brown at base, pale ochre distally. All wings ventrally pale yellow; forewings with conspicuous black-brown distal discoidal stigma, pale brown coloured apex, which is interrupted by a yellow line at costa; hindwings with brown apex too, and an inconspicuous spotted line parallel to termen. Male retinaculum with hamus.

Abdomen. Dorsally brown scaled, white edge along posterior margin of tergites; ventrally predominantly white coloured.

Male genitalia (Figs. 9–12). Uncus triangular. Gnathos slightly bent; broadly articulating along ventral edge of tegumen as characteristic for Evergestinae; dentate dorsally before distal tip. Valvae with straight dorsal edge, ventrally at base strongly convex, a folded, slightly stronger sclerotised field medially; juxta elongate ovate; vinculum slender. Phallus conspicuously blunt angled after two thirds from the anterior; opening of ductus ejaculatorius just anterior to this angle; within the posterior third, there are two ventro-lateral elongate fields of thorn-like cornuti close to the posterior edge of the phallodeme; anterior to this fields there are two lateral groups of larger cornuti, too.

Female genitalia (Fig. 13). Corpus bursae globular, with a pair of signa composed of numerous rectangular slerites, surrounded by needle-like sclerotisations; cervix bursae large funnel shaped; ductus bursae narrow; colliculum and antrum dorsally forming a sclerotised ring, open ventrally; sternite VIII very narrow; apophyses anteriores and apophyses posteriores short; papillae anales connected dorsally, strongly setose.

Variation (Figs. 2–8, 9–12b). Forewing length 8–12 mm; the six specimens from Namangan, north of the Fergana Valley, present a larger forewing length (11–12 mm) as all other specimens, including the primary types of *Evergestis heliacalis* and *E. anartalis* (Hampson) (8–10 mm). The quantity of hair like scales varies, especially around the head and dorsal side of thorax. Forewing dorsally with white basal line in some specimens absent, antemedian line and subterminal line more or less inconspicuous, shape of S-bent postmedian line varies slightly; and scales covering the hamus are pale yellow or brown coloured. The hindwing with dark-brown marginal band variable in width; the basal area in some specimens with large brown field, in some specimens occupying the entire inner edge of wing; ventrally, the spotted line is absent in some specimens. In male genitalia, dentation at distal tip of gnathos is reduced in some specimens and size of cornuti varies slightly. Variation of different characters do not correspond to each other. Females with somewhat broader forewings, comparing specimens of the same size.

Generic placement. The genus *Maelinoptera* Staudinger, 1893 with its only included species *Hercyna anartalis* Staudinger, 1892 has been described mainly by the presence of intensively yellow coloured hindwings, while most *Evergestis* species have pale-brown hindwings. However, all other morphological characters used for generic concepts in Evergestinae are so similar to *Evergestis*, that *Maelinoptera* Staudinger, 1893 **syn. rev.** is revised as a synonym of *Evergestis* Hübner, 1825 (type species: *Pyralis margaritalis* [Denis & Schiffermüller], 1775) here. So far, *Evergestis* is not proven as a monophyletic group, but the species included are so similar in morphology, especially that of genitalia, that there is no reason to doubt that they constitute a natural group. Some characters the *Evergestis* species have in common are in male genitalia the long and slender uncus and gnathos, the latter distally toothed and articulating from the ventral edges of tegumen, a long juxta, the valvae are simple and unarmed, and the phallus is obtusely angled behind the middle, in some species with cornuti. The females have well developed papillae anales, the bursa copulatrix is globular and has a pair of large signa (Munroe 1973; Goater, in press).

Life history. Adults have been collected between 19.vi.–20.vii. The early stages are unknown.

Distribution. The species is known only from Central Asia. All records with reliable data are related to localities at 2400–3550 m altitude, the sub-alpine and alpine meadows. Thus, it is assumed that *E. anartalis* Staudinger is endemic to the high mountains of Central Asia.

Remarks. The few specimens available for study suggests that only the six specimens from Namangan in the Fergana Valley present a larger forewing length (11–12 mm), while all other specimens with a smaller forewing length (8–10 mm) probably originate from higher altitudes, as indicated by those specimens collected more recently with more precise data. The specimens originating from higher altitudes also seem to have more black pigments suffused on thorax and forewings, as well as a higher quantity of hair like scales at head and thorax. Therefore, it might be possible that at least some of the variable character states are related to altitudinal adaptation. However, few specimens have been investigated only and it remains interesting to learn more about the factors influencing the variation. Overall variation shows no constant and distinct characters to separate species of the *Evergestis anartalis* complex. Therefore, *Evergestis heliacalis* Zerny, 1914 **syn. n.** and *Noctuelia anartalis* Hampson, 1918 **syn. n.** are synonymised here with *Evergestis anartalis* Staudinger, 1892 (*Hercyna*). Thus, *Noctuelia anartalis* Hampson becomes a junior secondary homonym of *Evergestis anartalis* Staudinger. In order to clearly verify the status of the species group names for the taxa investigated and to fix their name bearing types, lectotypes are designated for *Hercyna anartalis* Staudinger, 1892 and *Evergestis heliacalis* Zerny, 1914.

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Polyommatus dantchenkoi (Lukhtanov & Wiemers, 2003) tentatively identified as new to Europe, with a description of a new taxon from the Balkan Peninsula (Lycaenidae)

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Abstract. Karyological data have revealed the presence of a taxon corresponding to the recently described *Polyommatus* (*Agrodiaetus*) *dantchenkoi* (Lukhtanov & Wiemers, 2003) in the Rhodopi Mts. of Bulgaria. The find expands greatly the range of this karyospecies, previously known only from Van Province in SE Turkey. This population is identical in karyotype structure and haploid chromosome number (n=41–42) and has a generally similar external and genital morphology than *P.* (*A.*) *dantchenkoi.* On the other hand, the Rhodopi population differs morphologically from nominotypical *P.* (*A.*) *dantchenkoi* as well as from all other Balkan taxa of brown *Agrodiaetus.* For these reasons this population is here described as a separate taxon, *Polyommatus dantchenkoi orphicus* ssp. n.

Key words. karyotype, chromosome, *Polyommatus*, *Agrodiaetus*, *dantchenkoi, aroaniensis, ripartii, admetus,* Lycaenidae, Lepidoptera, Europe, Balkan Peninsula, Bulgaria, Rhodopi, *orphicus* new subspecies.

Introduction

The systematics of *Agrodiaetus* Hübner, 1822, a subgenus of *Polyommatus* Latreille, 1804 is presently in a state of upheaval. In addition to the steady flow of descriptions of new taxa, the first molecular phylogenies of the group (Wiemers 2003; Kandul et al. 2004) provided entirely new insights on the relationships within this highly complex and diverse subgenus. Most challenging is the taxonomy of the so-called monomorphic or ‘brown’ taxa, so named because of the uniform brown colour of the male upperside, similar to that of the female. The high species diversity of this group was brought to light in the 1960’s by the pioneering karyological research of H. De Lesse. Nowhere in the subgenus is reliance on karyology as important for taxonomy and systematics as in the brown taxa. Currently four species of brown *Agrodiaetus* are known from the Balkan Peninsula: *P.* (*A.*) *admetus* (Esper, [1783]), *P.* (*A.*) *ripartii* (Freyer, 1830), *P.* (*A.*) *aroaniensis* (Brown, 1976), and *P.* (*A.*) *nephohiptamenos* (Brown & Coutsis, 1978). The last two species are endemic to this region. Despite this diversity (the highest in Europe), karyological research on the Balkan brown *Agrodiaetus* has been sporadic to date and has concentrated almost exclusively on Greek populations (Brown 1976; Brown & Coutsis 1978; Coutsis et al. 1999; Wiemers 2003). The recent reports of *P.* (*A.*) *aroaniensis* and *P.* (*A.*) *nephohiptamenos* as new to Bulgaria (Kolev 1994) and *P.* (*A.*) *aroaniensis* as new to Former Yugoslav Republic of Macedonia (Kolev & Poorten 1997) have been based on morphological and anatomical characters. The only published karyological data from elsewhere in the peninsula remain those of H. de Lesse, who sampled *P.* (*A.*) *ripartii* and *P.* (*A.*) *admetus* in westernmost Bulgaria (Kalotina checkpoint) en route to Asia Minor (de Lesse 1960).

In 1999 a large mixed population of brown *Agrodiaetus* in the Rhodopi Mts. of southern Bulgaria has been found, which consists of two morphologically very similar taxa, *P.* (*A.*) *ripartii* and an unknown taxon. Analysis of karyological samples revealed that the latter differs from *P.* (*A.*) *ripartii* and *P.* (*A.*) *aroaniensis* in its karyotype as well as morphology. The karyotype of the Rhodopi population is identical with that of the recently described *P.* (*A.*) *dantchenkoi* (Lukhtanov & Wiemers, 2003) which so far is known only from its type locality, the Van Province of south-eastern Turkey (Lukhtanov et al. 2003). Thus the Rhodopi population can be considered the first record of *P.* (*A.*) *dantchenkoi* for the whole of Europe. However, the morphological differences between nominotypical *P.* (*A.*) *dantchenkoi* and the Rhodopi population as well as their considerable geographical separation prompted me to offer the following description of a new subspecies.

Abbreviations

IZS	Institute of Zoology, Sofia
n	haploid chromosome number
NMNHS	National Museum of Natural History, Sofia
ZK	collection of Zdravko Kolev, Helsinki

Methods

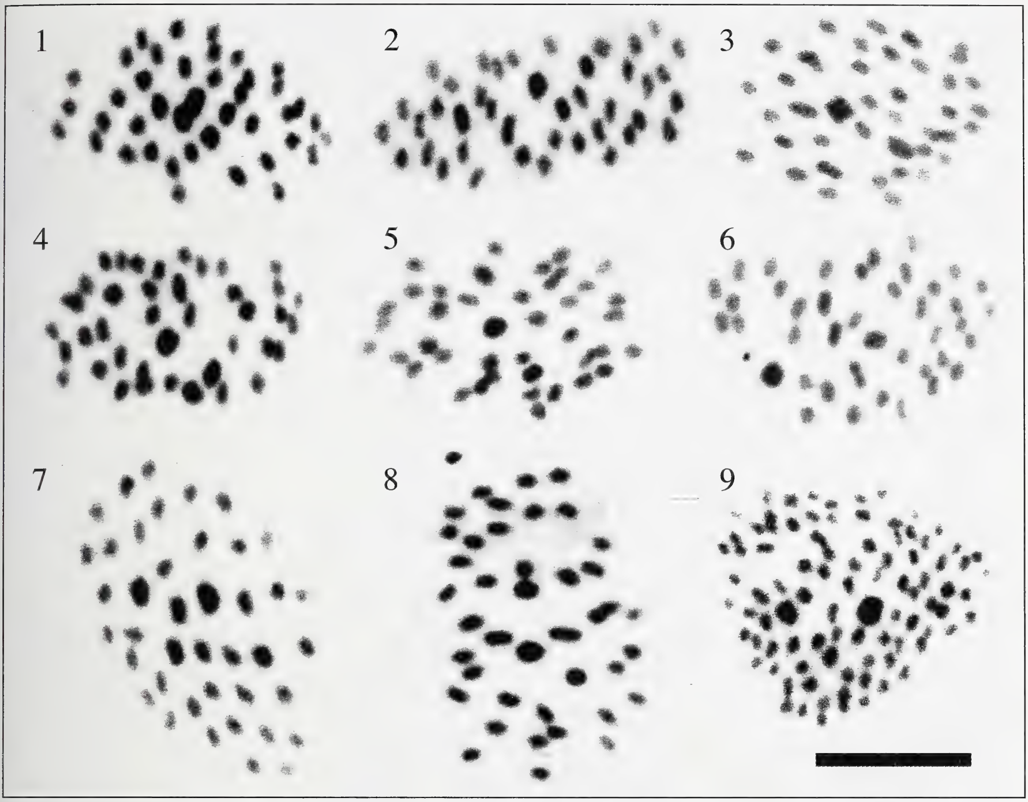
For karyological analysis males were collected and kept alive in moistened paperbags until the extraction of their testes was possible. Testes were fixed in a 3:1 solution of 96% ethanol and glacial acetic acid and refrigerated until further study. Preparations were made at the Department of Genetics, University of Turku (Finland) following an advanced methodology for studying holokinetic chromosomes developed by Dr. Seppo Nokkala (e.g. Grozeva & Nokkala 1996). Countable metaphase plates were photographed at a magnification of 1000× with an Olympus DP11 microscope digital camera system mounted on an Olympus BH-2 light microscope. The brightness and contrast of the digital images were enhanced for printing in Jasc Paint Shop Pro 7.04; no other image processing was applied.

For studying the genitalia, abdomens were macerated in a 10% solution of KOH, the genital structures were extracted, cleaned, measured, and drawn immersed at a magnification of 50× with the aid of camera lucida attached to a Wild stereomicroscope.

In attempting to establish the distribution of the new taxon and its relatives in Rhodopi, the public collections of the National Museum of Natural History (Sofia), the Institute of Zoology (Sofia), and the Museum of Natural History (Burgas) were examined. Additional material was received from the private collections of Mr. Julius Ganev (Sofia) and Dr. Stoyan Beshkov (Sofia).

Polyommatus dantchenkoi orphicus ssp. n. Figs. 1–8, 10–18, 33, 34, 39, 42

Material. Holotype ♂, white printed label 'S BG [**Bulgaria**], Rhodopi Mts., | open dry rocky slopes above | Hvoyna village, 800-950 m | 7.vii.1999, Z. Kolev leg.'; white hand-written label 'ZK99017'; red printed label 'Holotype | *Polyommatus* | *dantchenkoi* | *orphicus* ssp. n. | Z. Kolev det.'; ZK. – Paratypes 6♂, 2♀: same white printed labels as holotype except 1♀ (Figs. 11, 34), 'S BG [South Bulgaria], Rhodopi Mts., | open dry rocky slopes above | Hvoyna village, 800-950 m | 6.vii.1999, Z. Kolev leg.'; white hand-written labels (5♂) 'ZK99001', 'ZK99004', 'ZK99010', 'ZK99018' and 'ZK99019'; red printed label 'Paratype | *Polyommatus* | *dantchenkoi* | *orphicus* ssp. n. | Z. Kolev det.'; ZK. Part of the type material is to be deposited in NMNHS. – Additional material. 1♂: S Bulgaria, Rhodopi Mts., Lukovitsa gorge near Asenovgrad town, 400 m, 21.vi.1986, Beshkov leg., ZK; 1♀: same data but 21.vii.1998, Kolev leg., ZK; 1♀: Rhodopi Mts., "Persenk" mine, 25.vii.1977, Ganev leg., ZK; 1♀: Rhodopi Mts., vic. Gela village, 1500 m, 23.vii.1999, Kolev leg., ZK.



Figs. 1–8. Metaphase plates of *P.* (*A.*) *dantchenkoi orphicus* ssp. n. **1.** n=42, paratype (Fig. 16), prep. ZK99001-02. **2.** n=41, same specimen as Fig. 1, prep. ZK99001-15. **3.** n=42, same specimen as Fig. 1, prep. ZK99001-24. **4.** n=41, paratype (Fig. 14), prep. ZK99004-02. **5.** n=42, same specimen as Fig. 4, prep. ZK99004-14. **6.** n=42, holotype (Fig. 10), prep. ZK99017-04. **7.** n=41, same specimen as Fig. 6, prep. ZK99017-07. **8.** n=42, paratype (Fig. 15), prep. ZK99019-01.

Fig. 9. Metaphase plate of *P.* (*A.*) *ripartii* n=90, same specimen as Figs. 28 & 35, prep. ZK99011-02. Scale bar = 10 μm.

Description. Measurements. Relatively large for a brown *Agrodiaetus*. Male forewing length 13.0–18.2 mm (holotype 17.0 mm), mean 16.65 mm (8♂), female forewing length 14.5–16.5 mm, mean 15.3 mm (5♀).

Upperside. Resembles *P.* (*A.*) *aroaniensis* closely in both sexes. Ground colour dark brown with silky sheen and, in males, an extensive androconial field on forewing. Veins relatively inconspicuous in both sexes, not markedly darker than ground colour, giving upperside a smooth appearance. Discoidal spot in females darker than ground colour. Fringe brown, on hindwing brown or brownish-grey on distal half.

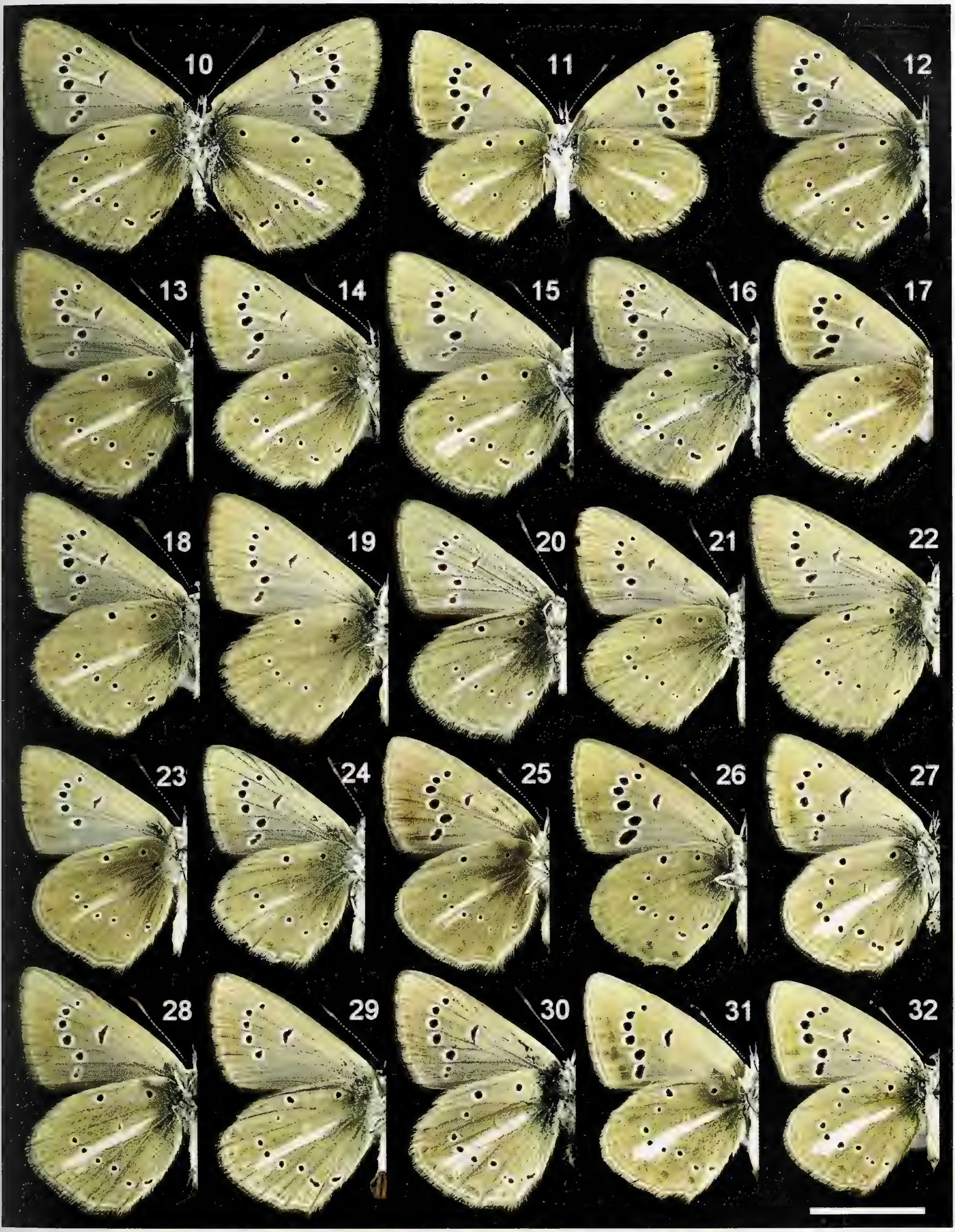
Underside. Ground colour warm, light to medium yellowish-brown, with basal half of forewing tinged colder grey. *Forewing*: Postdiscal black ocelli prominent, forming strongly curved row in spaces M3, Cu1 and Cu2, with ocelli in spaces Cu1 and Cu2 on straight, or nearly so, line with discoidal spot. Space M2, along vein M3, with narrow, diffuse but well visible white streak connecting discoidal and postdiscal spots in space M2 and often extending a short distance distad from latter. *Hindwing*: Greenish irridescent basal suffusion absent or almost so. Postdiscal black ocelli usually well-defined and in complete series, seldom some reduced. Ocelli in spaces M3, Cu1, Cu2 and A2 situated more basad than in *P.* (*A.*) *ripartii*, identical to those of *P.* (*A.*) *d. dantchenkoi* and *P.* (*A.*) *aroaniensis*. White streak in space M2 always prominent and sharply defined, its expression independent of degree of reduction of postdiscal ocelli. Submarginal markings diffuse and faint, only slightly darker than ground colour; reddish submarginal lunules absent or very faint and exceedingly small.

Male genitalia (Figs. 39 a, b, c). As in *P.* (*A.*) *aroaniensis* (Fig. 40) and *P.* (*A.*) *d. dantchenkoi*, of the 'long type' (Kolev & De Prins 1995). Valva 3.00–3.20 mm long, mean 3.11 mm (6 ♂), being significantly ($P<0.001$, two-tailed *t*-Test assuming equal variances) longer than in *P.* (*A.*) *ripartii* (Fig. 41): 2.36–2.71 mm, mean 2.59 mm (13♂). Within each taxon the length of valva generally increases with increasing individual size, as is only to be expected, but the morphometric difference between the male genitalia of *P.* (*A.*) *dorphicus* and *P.* (*A.*) *ripartii* is clearly not a function of of variable individual size. This is evident from Fig. 47, which shows a consistent gap between the ranges of variance in valva length of syntopic samples of the two taxa. This gap is remarkably wide, particularly in view of the almost total overlap of variance ranges in forewing length between the two taxa. Besides, the effect of individual variation on genital size can be eliminated by calculating and comparing individual values of the unit-less index FWL/VL, which is obtained by dividing the forewing length (FWL in mm) by the valva length (VL in mm). This index is 5.38–5.69 (mean 5.5683, 6♂) for *P.* (*A.*) *dorphicus* and 5.97–6.73 (mean 6.38, 13♂) for *P.* (*A.*) *ripartii*. The differences between the means of these non-overlapping ranges of variance is statistically significant ($P<0.001$, two-tailed t-test assuming equal variances). In other words, the valva of *P.* (*A.*) *orphicus* is disproportionally longer, relative to individual size, than that of *P.* (*A.*) *ripartii*.

Female genitalia (Fig. 42). Henia similar to that of *P.* (*A.*) *aroaniensis* (Fig. 43), with minor differences in sclerotisation and dimensions of unknown significance due to very limited number of females available for dissection. Henia of *P.* (*A.*) *ripartii* clearly shorter and stouter (Fig. 44), that of *P.* (*A.*) *admetus* much longer and more slender (Fig. 45).

Karyotype (Figs. 1–8). Clear countable metaphase plates, mostly MI, were obtained in preparations of five males: ZK99001, ZK99004, ZK99010, ZK99017, and ZK99019. In all plates that could be counted precisely the haploid chromosome number was $n=41–42$. The karyotype is identical in structure and chromosome number to that of *P.* (*A.*) *d. dantchenkoi* (Lukhtanov et al. 2003: 66) and in structure also to that of *P.* (*A.*) *aroaniensis* (Coutsis et al. 1999).

Differential diagnosis. From nominotypical *P.* (*A.*) *dantchenkoi* the new taxon is distinguished by the presence of a white postdiscal streak on the forewing underside, a generally larger postdiscal ocelli on the hindwing underside, and less contrasting veins on the upperside. From *P.* (*A.*) *aroaniensis*, which it resembles extremely closely on the upperside, the new taxon is distinguished by the constant presence of a clear white postdiscal streak on the forewing underside, as a rule a complete series of larger postdiscal spots on the underside, and the constant presence on the hindwing underside of a white streak (completely absent in at least half of the individuals in any given population of *P.* (*A.*) *aroaniensis*) which is wider, better defined, and more contrasting than in *P.* (*A.*) *aroaniensis* individuals possessing such a streak. From the sympatric and syntopic *P.* (*A.*) *ripartii* the new taxon is distinguished by the presence on the forewing underside of a white postdiscal streak and on average a more strongly curved row of postdiscal spots, and on the upperside the veins are less pronounced and



Figs. 10–18. Undersides of *P.* (*A.*) *dantchenkoi orphicus* ssp. n. **10.** Holotype ♂, S Bulgaria, Rhodopi Mts., open dry rocky slopes above Hvoyna village, 800–950 m, 7.vii.1999, Z. Kolev leg., ZK. **11–18.** Paratypes, same data, Figs. 12–16, 18: ♂; Figs. 11, 17: ♀, and Fig. 11 6.vii.1999. – **Figs. 19–26.** Underside of *P.* (*A.*) *aroaniensis*. **19.** ♂, SW Bulgaria, S Pirin Mts., vic. Paril village, 850 – 950 m, 30.vi.1994. **20.** ♂, SW Bulgaria, Mt. Alibotush, Hambar Dere gorge, 1500–1600 m, 11.vii.1993. **21, 22.** ♀, same data as Fig. 20, but 3.vii.1994. **23, 24.** ♂, S Bulgaria, Rhodopi Mts., vic. 'Trigradski skali' chalet, ca. 1400 m, 11.vii.2003. **25.** ♀, same data, as Fig. 19, but 1.vii.2003. **26.** ♀, SE Bulgaria, Stara Planina Mts., vic. Sliven, ca. 1000 m, 1–2.viii.1999. – **Figs. 27–32.** Undersides of *P.* (*A.*) *ripartii*. **27–30.** ♂, same data as Figs. 10–18. **31–32.** ♀, same data as Figs. 10–18. Scale bar = 1 cm.

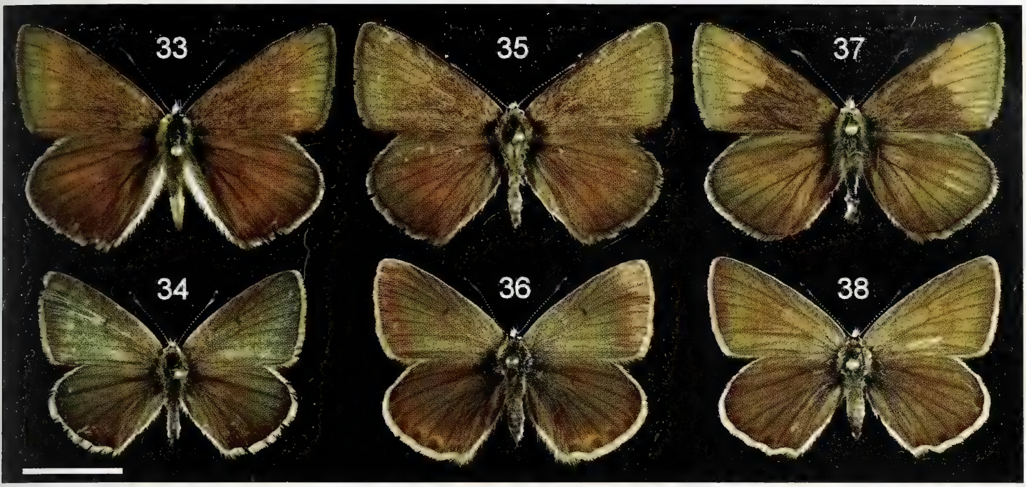
concolorous with the ground colour or only slightly darker. Worn individuals of the two taxa may be indistinguishable externally. A character that appears useful for separation of *P.* (*A.*) *ripartii* and *P.* (*A.*) *orphicus* is the longer valva in the male genitalia of *P.* (*A.*) *orphicus* which in the studied samples shows no numerical overlap with *P.* (*A.*) *ripartii* (see above). However, the samples studied are small and a further research into the significance of this character is therefore necessary. From the sympatric *P.* (*A.*) *admetus* the new taxon is very easily separated on account of the very distinct appearance of *P.* (*A.*) *admetus*, especially its strongly marked underside which almost never has a hindwing streak in the western part of the species' range.

Derivatio nominis. The adjective orphicus has two meanings: 'without apparent significance to the senses nor obvious to the intelligence; beyond ordinary understanding'; and 'ascribed to Orpheus'. Both meanings apply to *P.* (*A.*) *orphicus*: the former alludes to the highly cryptic appearance of the new taxon which can easily be confused with the sympatric *P.* (*A.*) *ripartii*, while the latter meaning refers to the range of *P.* (*A.*) orphicus: the Rhodopi Mountains, home to the mythical Thracian poet and musician Orpheus.

Life history. *P.* (*A.*) *orphicus* inhabits xerothermic and xeromontane calcareous localities. The vegetation of the type locality is sparse and dominated by low-growing xerophytous calciphilous species, with scattered *Juniperus* bushes and low *Pinus nigra* trees. In all known localities *P.* (*A.*) *orphicus* ssp. n. is syntopic with *P.* (*A.*) *ripartii*, which is widespread and abundant in calcareous habitats in the western Rhodopi (pers. observ.). The lowest known locality of *P.* (*A.*) *orphicus*, the gorge of Lukovitsa river, is a xerothermic submediterranean habitat supporting a very large population of *P.* (*A.*) *admetus* and a very small population of *P.* (*A.*) *ripartii*. In the type locality the ratio *ripartii* : *orphicus* equals 2.6 based on the collected unbiased sample of 32 specimens. There are as yet no observations regarding the larval host-plant of the new taxon.

Distribution. Collection material from three further localities in the western Rhodopi agrees well with *P.* (*A.*) *orphicus*, but this additional material (see above) is not included in the type series because no karyological data from these localities are available so far. Three known localities of *P.* (*A.*) *orphicus* (including the type locality) are situated in the gorge of the Chepelarska river at altitudes between 400 and 1100 m, the fourth (vic. Gela village) is on the northern slope of the Mursalitsa ridge at 1500 m. The habitats are situated on mostly karstified Proterozoic marbles of the Dobrostan formation (Zagorchev 1995) which are widespread in the western Rhodopi. Thus, it is to be expected that this taxon occurs elsewhere in Rhodopi as well.

Records of *P.* (*A.*) *aroaniensis* from Rhodopi have been very scarce so far. In Greece only two localities are known at low altitude in the southern foothills of the massif (Kolev & van der Poorten 1997; Coutsis & Ghavalás 2001). In the collection of IZS are preserved 1♂ from the 'Skalni Mostove' karst arches and 1♀ from the 'Kolarovski Livadi' locality, both specimens completely lacking a white streak on the hindwing underside. The first of these records corroborates a record of *P.* (*A.*) *aroaniensis* from "Čudnite mostovi" ['Chudnite Mostove' karst arches very close to Skalni Mostove] (Bálint 1995), based on specimens lacking a streak (Z. Bálint, in litt.). This locality is in immediate proximity to the known range of *P.* (*A.*) *orphicus*. In addition, during a short visit to the vicinity of 'Trigradski skali' chalet on 11.vii.2003 I collected a small sample (3♂, 1♀) with various degrees of reduction of the streak on the hindwing underside and lacking postdiscal streak on the forewing underside (Figs. 23, 24). Thus these specimens correspond well to *P.* (*A.*) *aroaniensis* and differ from *P.* (*A.*) *orphicus*



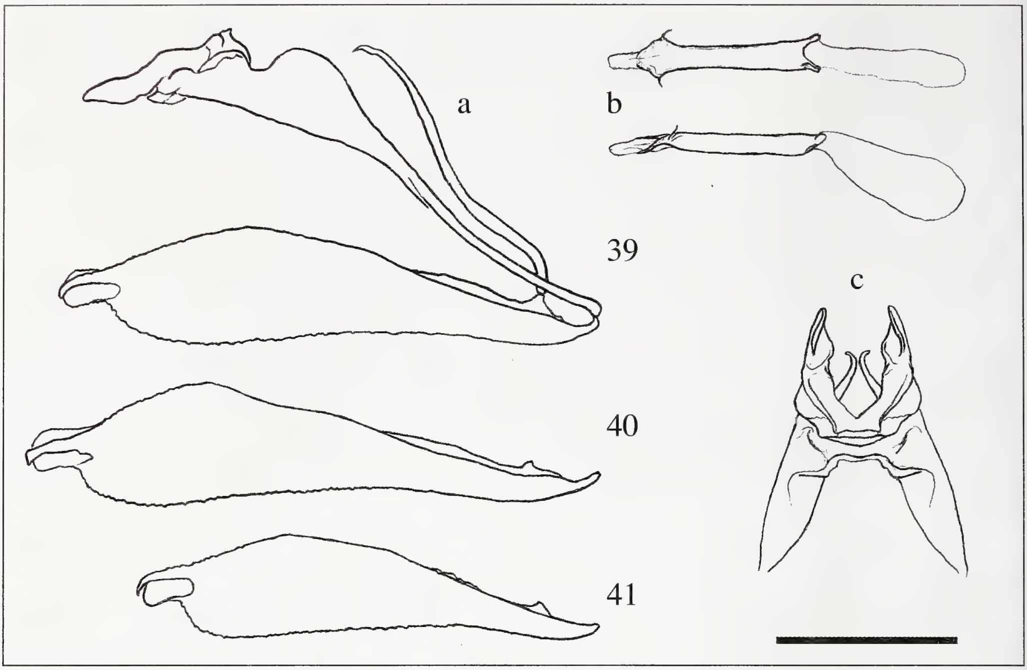
Figs. 33–34. Uppersides of *P.* (*A.*) *dantchenkoi orphicus* ssp. n. **33.** Paratype ♂, S Bulgaria, Rhodopi Mts., open dry rocky slopes above Hvoyna village, 800–950 m, 6.–7.vii.1999 (same specimen as Fig. 13). **34.** Paratype ♀, same data as Fig. 33 (same specimen as Fig. 11). – **Figs. 35–36.** Uppersides of *P.* (*A.*) *aroaniensis*. **35.** ♂, SW Bulgaria, S Pirin Mts., vic. Paril village, 850–950 m, 30.vi.1994 (same specimen as Fig. 19). **36.** ♀, same data as Fig. 35, but 1.vii.2003 (same specimen as Fig. 25). – **Figs. 37–38.** Uppersides of *P.* (*A.*) *ripartii*. **37.** ♂, same data as Fig. 33 (same specimen as Fig. 28). **38.** ♀, same data as Fig. 33 (same specimen as Fig. 31). Scale bar = 1 cm.

(samples for karyological analysis could not be obtained). The known records of *P.* (*A.*) *orphicus* and *P.* (*A.*) *aroaniensis* in Bulgaria are shown in Fig. 46. Syntopy of these two taxa has not been established so far, but is very likely in view of the very close proximity of their known ranges.

Discussion

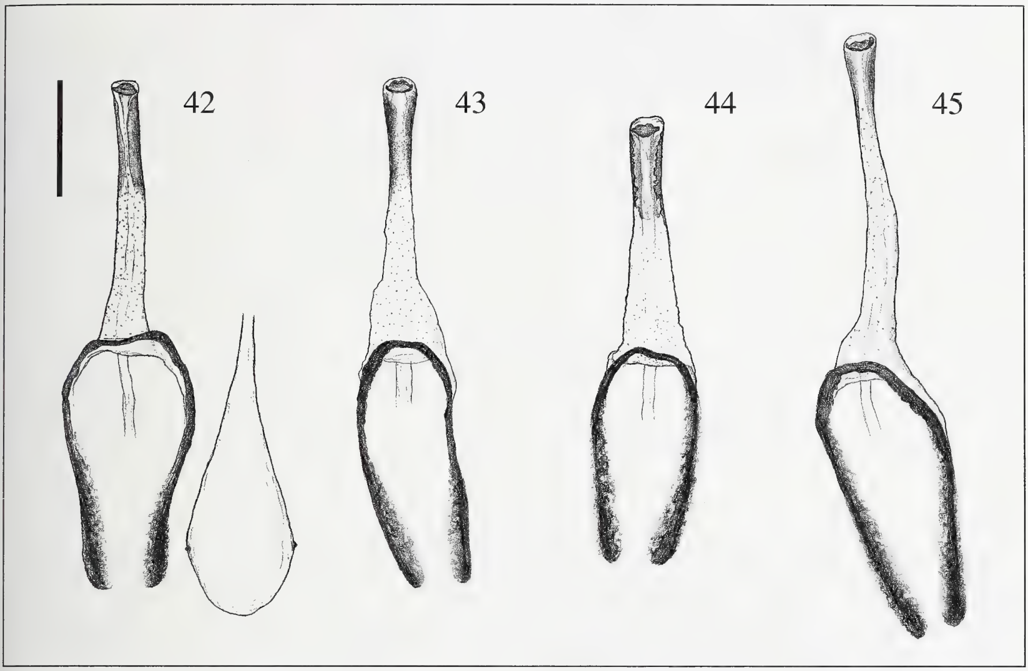
Morphologically *P.* (*A.*) *dantchenkoi orphicus* combines characters of *P.* (*A.*) *aroaniensis* (smooth dark brown upperside with inconspicuous veins) with characters of *P.* (*A.*) *ripartii* and nominotypical *P.* (*A.*) *dantchenkoi* (white streak on hindwing underside always present and very prominent; postdiscal ocelli usually prominent). The most conspicuous external character that separates *P.* (*A.*) *dorphicus* from these and all other *Agrodiaetus* taxa examined is the constant presence in the studied material of *P.* (*A.*) *dorphicus* of a whitish postdiscal streak along vein M3 in space M2 on the forewing underside. Based on examined material and photographs of brown *Agrodiaetus*, such a streak also occurs at very low frequencies in some taxa that have an underside hindwing streak. Thus, I have found only one specimen of Bulgarian *P.* (*A.*) *ripartii* with a forewing streak among more than 60 specimens examined.

Recent DNA research (Wiemers 2003; Kandul et al. 2004) indicates that the closest relatives of *P.* (*A.*) *d. dantchenkoi* are the Turkish taxa *P.* (*A.*) *alcestis* (Zerny, 1932) with n=19–21 and *P.* (*A.*) [*eriwanensis*] *interjectus* (de Lesse, 1960) with n=29–32 (Wiemers 2003), and the Transcaucasian *P.* (*A.*) *eriwanensis eriwanensis* (Forster, 1960) with n=29–34 (Lukhtanov et al. 2003; Kandul et al. 2004). Lukhtanov et al. (2003) stated that nominotypical *P.* (*A.*) *dantchenkoi* is also phenotypically most similar to *P.* (*A.*) *e. eriwanensis* and *P.* (*A.*) *e. interjectus*. According to Wiemers (2003) these taxa form a



Figs. 39–41. Male genitalia. **39.** *P.* (*A.*) *dantchenkoi orphicus* ssp. n., paratype (ZK99001) (same specimen as Fig. 16). **a.** lateral view, aedeagus removed, setae and membranous parts omitted. **b.** dorsoventral (above) and lateral (below) view of aedeagus including caecum. **c.** uncus and tegumen, dorsal view. **40.** Valva of *P.* (*A.*) *aroaniensis*, SW Bulgaria, Mt. Alibotush, Hambar Dere gorge, 1500–1600 m, 3.vii.1994 (same specimen as Fig. 22). **41.** Valva of *P.* (*A.*) *ripartii* (ZK99005), S Bulgaria, Rhodopi Mts., open dry rocky slopes above Hvoyna village, 800–950 m, 6–7.vii.1999. Scale bar = 1 mm.

cluster whose sister group is formed by the closely related *P.* (*A.*) *aroaniensis* and *P.* (*A.*) *humedasae* (Toso & Baletto 1976), the latter endemic to the Aosta valley in northern Italy. The taxonomic status of *P.* (*A.*) *orphicus* as presently proposed is tentative. It is possible that this taxon is a distinct species despite the identical karyotypes of *P.* (*A.*) *d. dantchenkoi*. Conspecificity of *P.* (*A.*) *orphicus* and *P.* (*A.*) *aroaniensis* is unlikely considering the difference of six chromosome pairs in their karyotypes (Lukhtanov et al. 2003), the morphological differences, and the fact that these taxa occur in close proximity, possibly sympatrically and syntopically, in the western Rhodopi. Conspecificity with *P.* (*A.*) *dantchenkoi* might be challenged by the morphological differences between the two taxa and the considerable distance between their ranges. This distance, over 1500 km, is particularly great considering the very small ranges of many *Agrodiaetus* taxa. It must also be stressed that nominotypical *P.* (*A.*) *dantchenkoi* is so far only known from a region characterized by very high butterfly endemism, especially among Lycaenidae. This region has very little zoogeographical affinity with the central Balkan Peninsula in general and the Rhodopi Mts. in particular. While the occurrence of *P.* (*A.*) *dantchenkoi* further west in Turkey is not impossible, it is notable that so far other researchers have not come across such karyologically distinct populations in central Turkey. Thus, for the time being *P.* (*A.*) *dorphicus* is not given species status owing to the fact that its karyotype is identical to that of *P.* (*A.*) *dantchenkoi*. Molecular studies are needed to resolve the status of this new taxon.



Figs. 42–45. Female genitalia. **42.** *P.* (*A.*) *dantchenkoi orphicus* ssp. n., paratype (same specimen as Fig. 17). **43.** *P.* (*A.*) *aroaniensis*, SW Bulgaria, S Pirin Mts., vic. Paril village, 850–950 m, 30.vi.1994. **44.** *P.* (*A.*) *ripartii* (ZK99005), S Bulgaria, Rhodopi Mts., open dry rocky slopes above Hvoyna village, 800–950 m, 6.–7.vii.1999. **45.** *P.* (*A.*) *admetus*, S Bulgaria, Rhodopi Mts., vic. Asenovgrad, Asenova krepost, 400–500 m, 17.vii.1992. Scale bar = 1 mm.

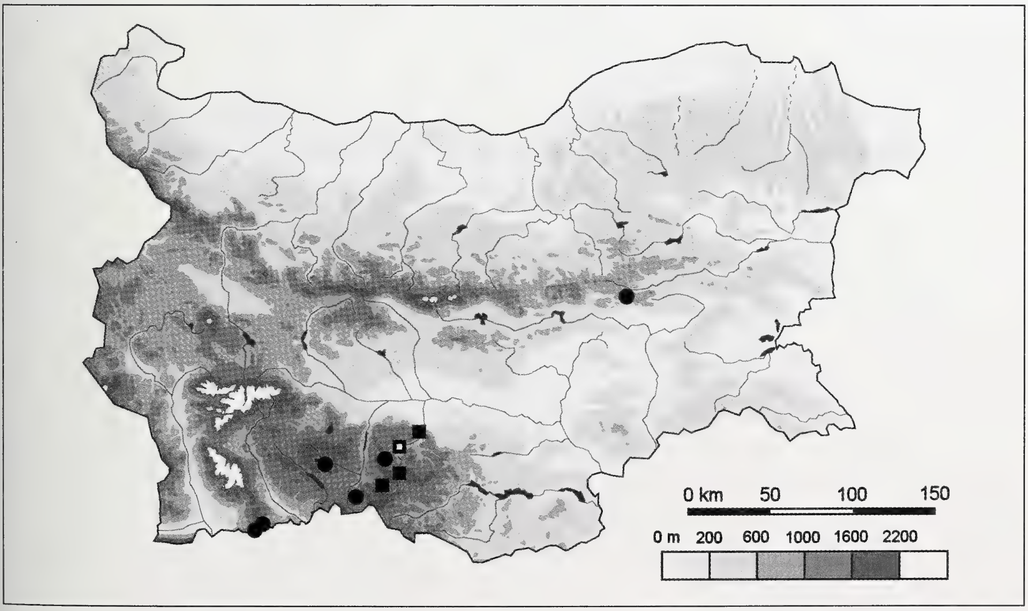


Fig. 46. Map of Bulgaria with records of *P.* (*A.*) *dantchenkoi orphicus* (squares; white-centred: type locality) and *P.* (*A.*) *aroaniensis* (circles).

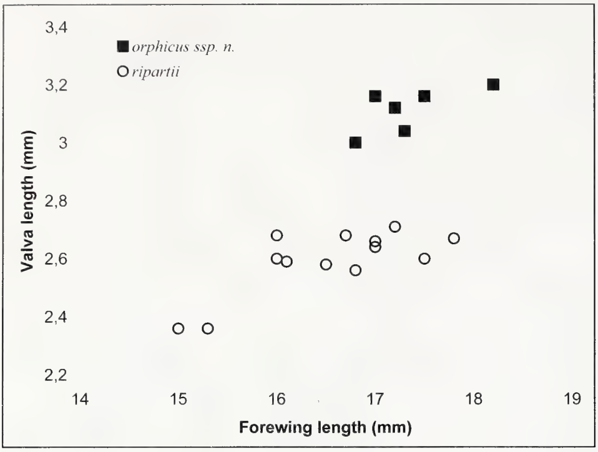


Fig. 47. Scatter diagram of individual values of forewing and valva length in *P.* (*A.*) *orphicus* (squares) and sympatric and syntopic *P.* (*A.*) *ripartii* (circles). All specimens determined from chromosome counts. Note the virtually complete overlap of forewing lengths of the two taxa but the lack of overlap between their valva length.

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New data on the taxonomic status and distribution of *Polyommatus andronicus* Coutsis & Ghavalas, 1995 (Lycaenidae)

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Summary. This paper details the first records of the poorly known and controversial taxon *Polyommatus andronicus* Coutsis & Ghavalas, 1995 from Southwestern Bulgaria (Mt. Alibotush, southern and central Pirin Mts.). This is a significant extension of the known range of this taxon, previously known only from NE Greece. The characters used to justify the species status of *P. andronicus* are re-evaluated. Statistical confirmation was obtained for the differences in mean wing length and male genitalia size, which support the specific distinctness of this taxon. The geographical and altitudinal range, habitat preferences, possible effects of human activity on its distribution, as well as the conservation status of *P. andronicus* are discussed.

Key words. Lepidoptera, Lycaenidae, *Polyommatus*, *P. icarus*, *P. andronicus*, genitalia, taxonomy, biometrics, sympatry, syntopy, distribution, endemism, Balkan Peninsula, Bulgaria.

Introduction

The nominal taxon *Polyommatus andronicus* Coutsis & Ghavalas, 1995 was described from north-eastern Greece on the basis of several morphological, anatomical, and ecological differences from its closest relative, the widespread *Polyommatus icarus* (Rottemburg, 1775). Compared to *P. icarus*, the original description states that *P. andronicus* is larger and with slightly broader forewings; the upperside colour in males is darker, deeper violet-blue; and the male and female genitalia are constantly and disproportionately larger. In addition, *P. andronicus* was reported to be univoltine and found only higher than 1000 m, being syntopic and synchronous with second-brood *P. icarus* (Coutsis & Ghavalas 1995). Coutsis & Ghavalas (1996) reported one further difference: under UV-light the wing underside was found to have a different reflection pattern, being as a whole more reflective in *P. andronicus* than in *P. icarus*.

Ten years later, the taxonomic status of *P. andronicus* is still ambiguous. Although some recent authors listed it as such (e.g. Karsholt & Razowski 1996; Tolman & Lewington 1997; Tolman 2001), others did not recognize it as separate from *P. icarus* (Kudrna 1996, 2002; Bálint & Johnson 1997). The latter view is not difficult to understand. *P. icarus* exhibits considerable individual, seasonal and geographical variation over its vast range and, while actually noting this, Coutsis & Ghavalas (1995) stated that "superficial differentiating characters [between *P. icarus* and *P. andronicus*] are, as far as we can tell, statistical rather than absolute." However, regrettably, they did not back their claim with the statistical analysis that such a claim invites. Moreover, a very recently published molecular study seemed to seal the fate of *P. andronicus* as just another synonym of *P. icarus*: the former was found to be exceedingly close genetically to Greek *P. icarus* and its separation from the latter was stated to have been "based on disputable evidence" (Wiemers 2003: 90). Yet the fact remains that to this day no one has specifically set out to refute or confirm the evidence presented by Coutsis & Ghavalas (1995).

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Coutsis & Ghavalas (1995) stated that *P. andronicus* was only found on the closely clustered massifs of Falakró, Meníkio, and Órvilos in the district of Drama. Órvilos is a compact massif straddling the border between Greece and Bulgaria and is known in the latter country under the names Alibotush and Slavyanka. I collected on Alibotush on several occasions, most extensively during July 1993 and 1994. In 1996, after acquainting myself with the description of *P. andronicus*, I re-examined my material from Alibotush and discovered a large *Polyommatus* female corresponding closely to that description. This female, collected on 11.vii.1993 in the karst gorge of Hambar Dere, southwest of Paril village at an altitude of ca. 1400 m, markedly exceeds the maximum size reached by female *P. icarus* in Bulgaria. Its forewing measures 18.6 mm against a maximum of 17.0 mm for the Bulgarian female *P. icarus* that I examined (n=34♀), which is also exactly the maximum reported for Greek female *P. icarus* (Coutsis & Ghavalas 1995). The tentative identification of this specimen as *P. andronicus* was confirmed by John G. Coutsis who examined its genitalia in 1997 and found them to be of the large *P. andronicus* type (Coutsis, pers. comm.). This female represents the first record of *P. andronicus* from Bulgaria, which I communicated to Tom Tolman. On the basis of this information, Alibotush was listed as part of the range of *P. andronicus* (Tolman 2001: 122).

The large size of this female and its genitalia show that it conforms to the description of the nominal taxon *Polyommatus andronicus*, but this in itself does not constitute proof of specific distinctness of this taxon from *P. icarus*. Such evidence, as was said above, is sorely needed. The lack of more specimens from Alibotush and the difficult access to this border region unfortunately prevented me from gathering a more representative sample for assessing the taxonomic rank of *P. andronicus*. This discovery, however, prompted me to conduct purposeful search for *P. andronicus* in other mountains immediately adjacent to Alibotush.

Methods

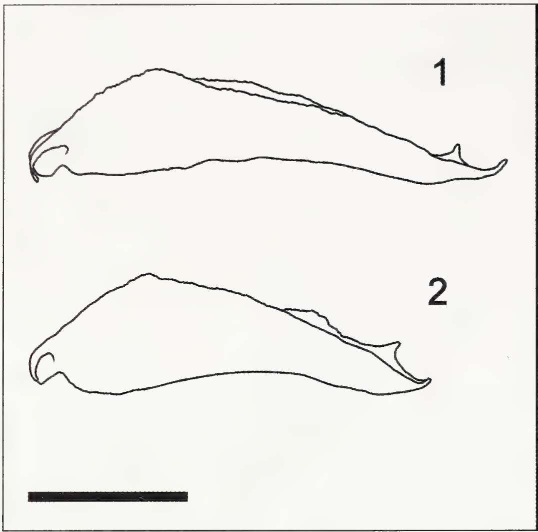
Material. Specimens with *P. icarus*-like morphology were collected on two separate field trips to the southern and central parts of the Pirin range, situated immediately to the north of Alibotush. The study area is shown in Fig. 25. In geomorphological terms Pirin and Alibotush are really no more than parts of the same massif (Zagorchev 1995) with their flora also showing a great degree of similarity (Bondev 1991) and it was expected that their butterfly faunas would also be very similar, as indeed they turned out to be. The first trip, carried out during 25.–26.vii.1998, concentrated on the region between the Popovi Livadi pass (ca. 1400 m) and the highest summit of central Pirin, Orelek (2099 m). On my second trip, during 30.vi.–4.vii.2003, I was accompanied part of the time by Mr. Slobodan Davkov (Skopje). Together we studied more exhaustively the region which I had visited in 1998, collecting as low as ca. 700 m in southern Pirin. Following that I visited the montane and subalpine zone of southern Pirin, in the region of its highest peak, Sveshtnik (1975 m). In preparation for this comparative analysis, I also collected a comparative sample of *P. icarus* from various other localities in Bulgaria encompassing the whole resident altitudinal range of *P. icarus* from sea level to ca. 1900 m and the whole gamut of habitats occupied by *P. icarus*, from xerothermic to subalpine.

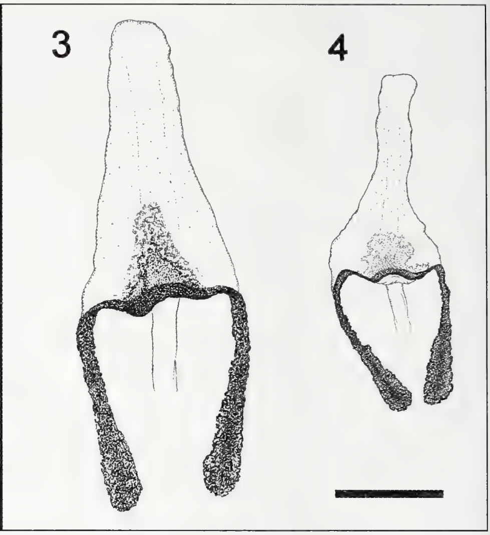
Wing and genital measurements were taken using an eyepiece-mounted scale bar on a Wild stereomicroscope. Wings of set specimens were measured from wing base to tip, including fringe, with an accuracy of 0.1 mm. Genitalia were extracted following maceration of the abdomen in a 10 % solution of KOH, cleaned of residual tissue, and measured. The length of the male genitalia was measured from the base to the tip of the valva with an accuracy of 0.01 mm. In addition, the numerical data provided by Coutsis & Ghavalas (1995) for Greek *P. icarus* and *P. andronicus* were included in the analysis. For the wing (FWL) and valva (VL) measurements a unit-less index FWL/VL was calculated to eliminate the effect of overall size variation. The means were statistically evaluated using a Student's two-tailed *t*-Test with assumed equal variances.

Karyology. The haploid chromosome number in *P. icarus* and all studied species of the *Peros-eroides* complex is n=23 (Robinson 1971: 569). However, *P. buzulmavi* Carbonell, 1992 from the Turkish provinces of Hakkari and Van, a taxon morphologically similar to *P. icarus* and *P. andronicus*, has a very different karyotype with n=45 (Puplesiene & Olivier 2000). It was therefore considered of importance to study the karyotype of specimens tentatively identified as *P. andronicus*. Testes were extracted, fixed in the field in a 3:1 solution of 96 % ethanol and glacial acetic acid, and refrigerated until further study. Preparations were made at the Department of Genetics, University of Turku, Finland following a methodology developed by Dr. Seppo Nokkala (Grozeva & Nokkala 1996). Countable first-metaphase (MI) plates were photographed at a magnification of 1000× with an Olympus DP11 microscope digital camera system mounted on an Olympus BH-2 light microscope. The brightness and contrast of the images were enhanced in Jasc Paint Shop Pro 7.04; no other post-processing was applied.

Results

Already on first examination in the field most of the collected specimens fell naturally into two groups: smaller, lighter blue males corresponding to *P. icarus* and larger, darker males corresponding to *P. andronicus* as described by Coutsis & Ghavalas (1995). However, external characters (size, colour, underside pattern) and condition of the individuals were found to be variable to the extent that the placement of many specimens was uncertain. For this reason, the first stage of the analysis was a morphometric study of the male genitalia, the only character that according to Coutsis & Ghavalas (1995) shows no numerical overlap between the two taxa. Rather than applying statistical analysis, these authors illustrated the forewings and valvae of eight *P. icarus* and six *P. andronicus* specimens on pls. 5–9 (pp. 154–156). While showing the existence of size differences, this form of presentation is not well suited for assessing their significance, especially as all illustrated *P. icarus* are of approximately the same large to very large size and thus do not reflect the size variation in this species as a whole.





Figs. 1–2. Lateral view of the left valva (setae omitted). **1.** *P. andronicus* ♂, Central Pirin, below Dobro Pole plateau, 1800–1900 m, 26.vi.1998 (forewing length 17.7 mm). **2.** *P. icarus* ♂, East Bulgaria, East Stara Planina Mts., Karandila nature park, 1000 m, 16.vi.1999 (forewing length 17.7 mm).

Figs. 3–4. Dorsoventral view of the female genitalia (bursa and part of ductus bursae omitted). **3.** *P. andronicus* ♀, Central Pirin, Popovi Livadi – Orelek, 1600 m, 2.vii.2003 (forewing length 17.3 mm). **4.** *P. icarus* ♀, Pirin, Popovi Livadi, 1400 m, 1.vii.2003 (forewing length 14 mm). Scale bars = 1 mm.

Genitalia. There is a strong dichotomy in the size of male and female genitalia in the sample from Pirin (Figs. 1–4). The valva length values fall into two clear-cut groups with no overlapping values whatsoever (Figs. 5, 6), and their means of variance differ very significantly (P<0.0001). Values and variance in these groups match well the numerical values given by Coutsis & Ghavalas (1995). Given these strong similarities, for simplicity throughout this chapter I shall refer to the group with smaller male and female genitalia as the '(Pirin) *P. icarus*' and to that with larger genitalia as the '(Pirin) *P. andronicus*' respectively. Note however that this should not be taken as a taxonomic conclusion regarding the species status of the latter taxon at this point.

Coutsis & Ghavalas (1995) stated that the male genitalia of *P. andronicus* are disproportionately larger than those of *P. icarus*, but this assertion was not tested in a statistically meaningful way. To do this the FWL/VL ratio is used here (Tab. 1). The mean ratio for *P. andronicus* (5.66) is significantly (P<0.0001) smaller than the mean ratio for *P. icarus* (6.38). This confirms that in *P. andronicus* the genitalia are on average larger relative to the individual's size than they are in *P. icarus*.

Female genitalia in the Pirin material likewise show a clear dichotomy in the size and shape of genitalia, though this is more difficult to quantify and analyze because, on one hand, the female genitalia are largely membranous and thus susceptible to distortion, and on the other hand, the number of available *P. andronicus* females was very small. Due to this a statistical analysis was not attempted. Nevertheless, the difference observed bears out the observations of Coutsis & Ghavalas (1995), with the genitalia being clearly longer and more massive in Pirin *P. andronicus* than in Pirin and other Bulgarian *P. icarus* (Figs. 3, 4).

Tab. 1. Pooled key measurements of males of *P. icarus* from the Pirin Mts., *P. andronicus* and *P. icarus* from other localities in Bulgaria, as well as of *P. icarus* and *P. andronicus* from Greece (the latter taken from Coutsis & Ghavalas 1995), with confidence levels for the differences in means (Student's two-way *t*-Test).

Character	***P. icarus* (52 ♂)**			***P. andronicus* (29♂)**			**confidence level (P)**
	min	max	mean	min	max	mean	
Forewing length FWL (mm)	11.3	17.7	15.42	16.10	19.50	18.07	<0.0001
Valva length VL (mm)	1.96	2.62	2.42	2.84	3.50	3.19	<0.0001
Index FWL/VL	5.59	7.06	6.38	5.21	6.16	5.66	<0.0001

Morphology. Having established the marked dichotomy of the Pirin sample in terms of genital characters, it has to be seen if and how these differences in genital morphology correlate with differences in external morphology.

Size. The Pirin *P. icarus* correspond well to other Bulgarian *P. icarus* from similar altitudes (700–1850 m) while the Pirin *P. andronicus*, collected between 1600 and 1950 m, are on average larger. The female from Alibotush clearly falls inside this latter group. As was said above, the forewing length variance of the Pirin *P. andronicus* partially overlaps that of Bulgarian *P. icarus* (see Tab. 1 and Figs. 7–22). Nevertheless, the difference between the means is statistically very significant (P<0.0001) in the males (Tab. 1), and whereas an insufficient number of females of Pirin *P. andronicus* was available for analysis, there appears to be a similar degree of difference in female wing length too.

Wing shape. Coutsis & Ghavalas (1995) stated that the forewing in male *P. andronicus* is broader than in *P. icarus*, and illustrated this with drawings of forewings to scale (pp. 154–156) but, again, provided no numerical values. Examination of my material does not support this character, which shows no clear correlation with the two distinct valva types. Many Pirin *P. andronicus* (e.g. Fig. 13) have markedly narrow and pointed forewings while many Pirin (and other Bulgarian) *P. icarus* have very broad wings. Variation in this character is so considerable in both groups that further analysis was not considered necessary.

Upperside colour in males. Coutsis & Ghavalas (1995) noted that on average male *P. andronicus* have a deeper, darker blue upperside colour than *P. icarus*. Such difference however is difficult to see in colour plate 10 of the original description, where in addition the blue of both *P. icarus* and *P. andronicus* specimens has an unnatural, silvery cast when compared to actual specimens. The Pirin *P. andronicus* do have a remarkably uniform darker blue corresponding well to the description of *P. andronicus*, while fresh *P. icarus* from Pirin are generally lighter, as in most other Bulgarian *P. icarus*. However, this difference, if at all real, is clearly visible only in fresh or almost fresh specimens. In older males of both series the upperside colour is more difficult to determine due to loss of wing scales and membrane. Furthermore,

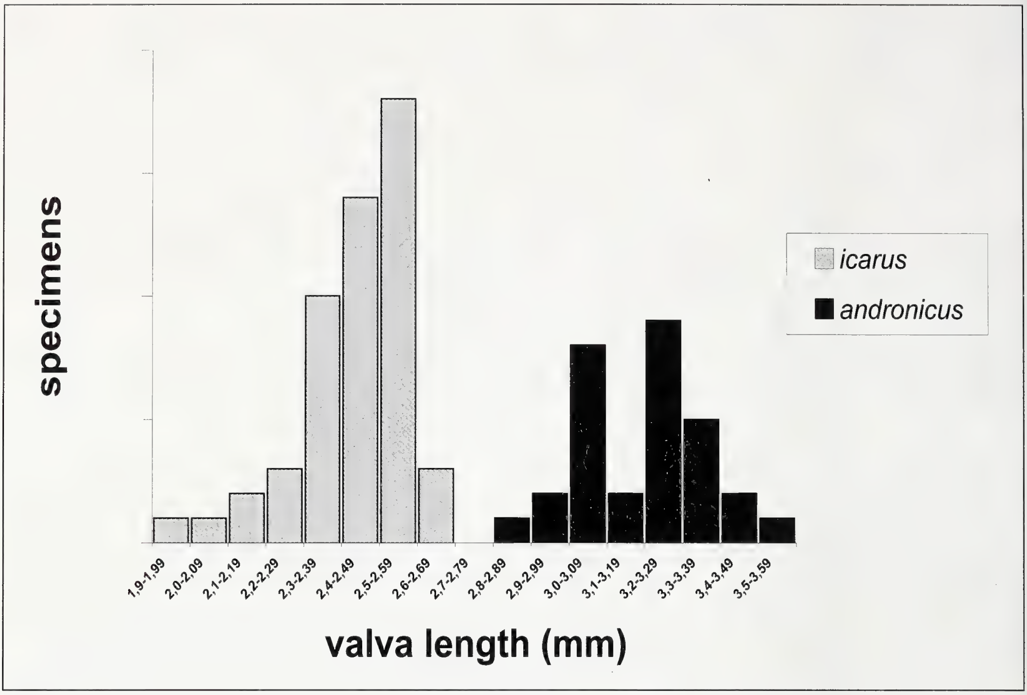


Fig. 5. Distribution of valva length values in male *P. icarus* and *P. andronicus*. Original data from Bulgaria are combined with numerical data from Coutsis & Ghavalas (1995).

the tone of the male upperside colour exhibits great seasonal and individual variability in *P. icarus*, even in fresh specimens. Likewise, occasionally, *P. andronicus* males have a lighter blue shine similar to that of *P. icarus* (Coutsis & Ghavalas 1995: pl. 10 fig. 4). The female upperside ground colour and the development and colour of the submarginal lunules are identical in the Pirin *P. icarus* and *P. andronicus*. Compared to the former, as well as other Bulgarian *P. icarus*, the only difference appears to be that Pirin *P. andronicus* females either lack completely (as does the Alibotush female) or have very limited blue basal suffusion. This suffusion is much more variable and often very extensive in other Bulgarian *P. icarus*. This upholds the stated difference between females of Greek *P. andronicus* and *P. icarus* (Coutsis & Ghavalas 1995).

Underside pattern. There is considerable variation both in terms of ground colour and development of maculation in both series. The Pirin *P. andronicus* are on average slightly more boldly marked with larger black spots. The wedge-shaped distal extensions of the white ring surrounding the discal spot on the fore- and hindwings are on average longer, wider at the base, and altogether more prominent than in Pirin or other Bulgarian *P. icarus*. However, there is some variation in this character in *P. icarus*, with these wedge-like markings being sometimes well developed. The metallic blue-green basal suffusion on the underside of the hindwing is extensive in Pirin *P. andronicus* males while on average much more restricted or nearly absent in the summer brood male Pirin (and other Bulgarian) *P. icarus*. A few very worn *P. icarus*

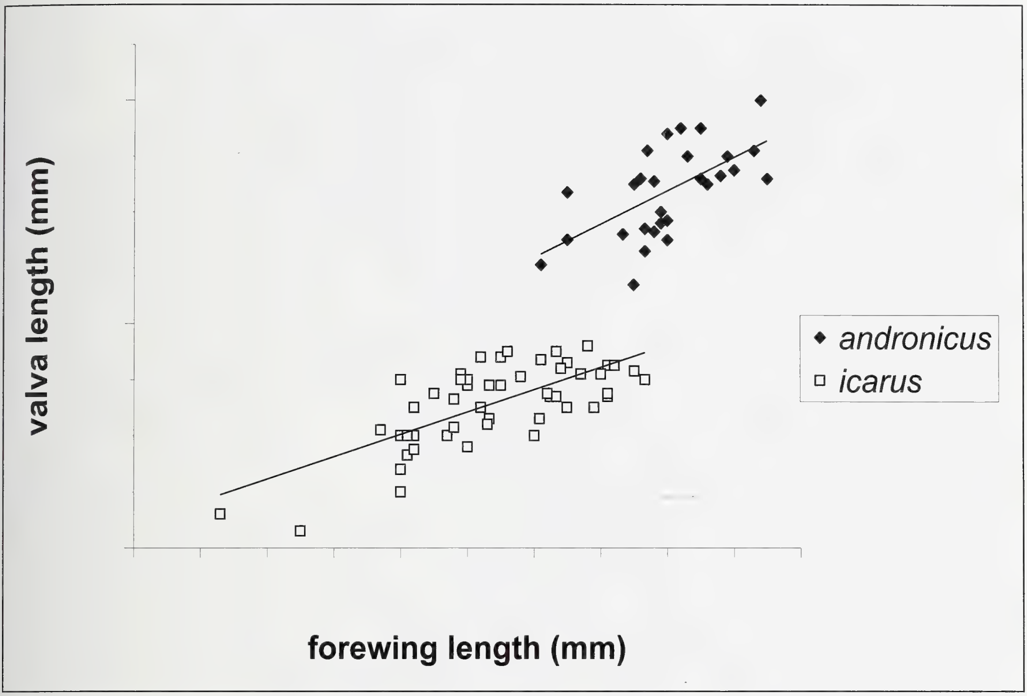


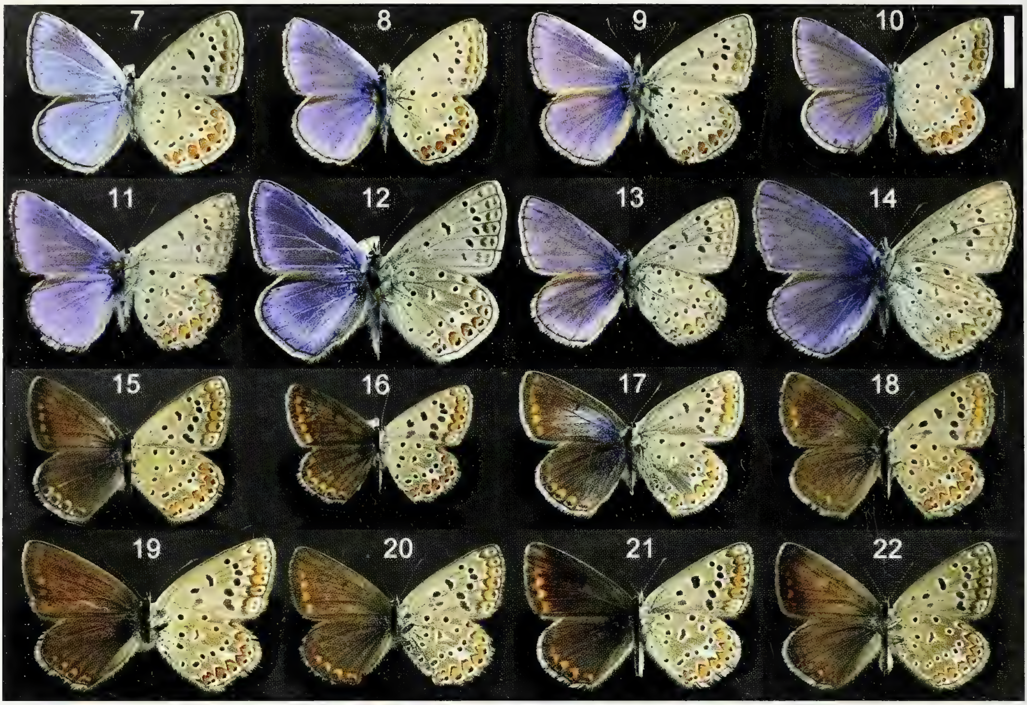
Fig. 6. Correlation of valva and forewing lengths of male *P. andronicus* and *P. icarus*, with trend lines. Original data from Bulgaria are combined with numerical data from Coutsis & Ghavalas (1995).

of the spring brood collected at higher altitudes in Pirin show extensive basal suffusion similar to that of the Pirin *P. andronicus*. All of these traits correspond to those observed in Greek *P. andronicus* and *P. icarus* (Coutsis & Ghavalas 1995).

Karyotype. More than 20 countable first-metaphase (MI) plates with a stable haploid number of n=23 (Fig. 23) were found in preparations of testes from two males of Pirin *P. andronicus* (No ZK0303 and No ZK0304). The karyotype of *P. andronicus* is thus identical to that of *P. icarus*.

Altitudinal range, sympatry and syntopy. The Pirin *P. icarus* were found in flowery open places in the deciduous and coniferous forest zones from the lowest foothills to the tree line at 1800–1850 m. This corresponds well to the upper limit of the resident range of *P. icarus* on other high mountains in Bulgaria (pers. observ.) and Greece (Coutsis & Ghavalas 1995). In contrast, Pirin *P. andronicus* were not found lower than 1500 m, but as high as ca. 1950 m. However, my observations at the latter altitude, on the slopes below the summit of Orelek, indicate that *P. andronicus* may range freely as high as Orelek itself (2099 m); there is certainly no physical barrier to prevent them from doing so and the habitats close to the summit are basically the same as at 1950 m.

In Pirin *P. icarus* and *P. andronicus* were found syntopically in flowery open habitats (roadsides, forest glades, and subalpine meadows) between ca. 1500–1850 m; no habitat segregation was apparent between the two there. This situation closely corresponds to



Figs. 7–22. Uppersides (two upper rows) and undersides (two lower rows) of *P. icarus* (**7–10**, **15–18**) and *P. andronicus* (**11–14**, **19–22**). **7–4: ♂♂, 15–22: ♀♀. 7, 12, 14, 15, 22.** Central Pirin, Popovi Livadi – Orelek, 1600 m, 2.vii.2003. **8.** South Pirin, Popovi Livadi – Sveshtnik, 1400–1500 m, 3.vii.2003. **9.** East Stara Planina Mts., Karandila nature park, 1000 m, 1–2.viii.1999. **10, 16.** Pirin, Popovi Livadi, 1400 m, 1.vii.2003. **11, 21.** South Pirin, Sveshtnik, 1850–1950 m, 3.vii.2003. **13, 20.** Central Pirin, below Dobro Pole plateau, 1800–1900 m, 26.vi.1998. **19.** Alibotush, Hambar Dere gorge, 1400 m, 11.vii.1993. **17.** Rhodopi, Smolyan, 1000 m, 16.v.1990. **18.** Same data as 3, but 19.–20.vii.1999. All leg. et coll. Kolev. Scale bar = 1 cm.

that described for *P. icarus* and *P. andronicus* in NE Greece, except that in Greece the published upper limit for both *P. icarus* and *P. andronicus* is given as 1800 m (Coutsis & Ghavalas 1995). However, this is rather due to the fact that observations from higher altitudes are lacking so far and *P. andronicus* is expected to occur higher than 1800 m in its Greek range as well (Coutsis, in litt.). In confirmation of this I am informed that *P. andronicus* has been discovered between 1900 and 2000 m on Falakró in the summer of 2004 (Davkov, in litt.).

Voltinism. Judging by the condition of the Pirin *P. andronicus* collected in the first days of July 2003, some of which were very worn, it can be concluded that the first had emerged already in mid-June. Emergence appears to be protracted: among the small, as a whole very worn series collected in late July 1998, there were a male and a female in relatively good condition. Thus, it can be anticipated that the imago flies from the second half of June till early or mid-August, like other univoltine Lycaenidae inhabiting this altitude zone in the study region, such as e.g. *Lycaena candens*, *Plebeius artaxerxes*, *Polyommatus eroides*, *P. escheri dalmaticus*, *P. nephohiptamenos*, and *P. coridon*. All these species were encountered during both collecting seasons and their emergence had

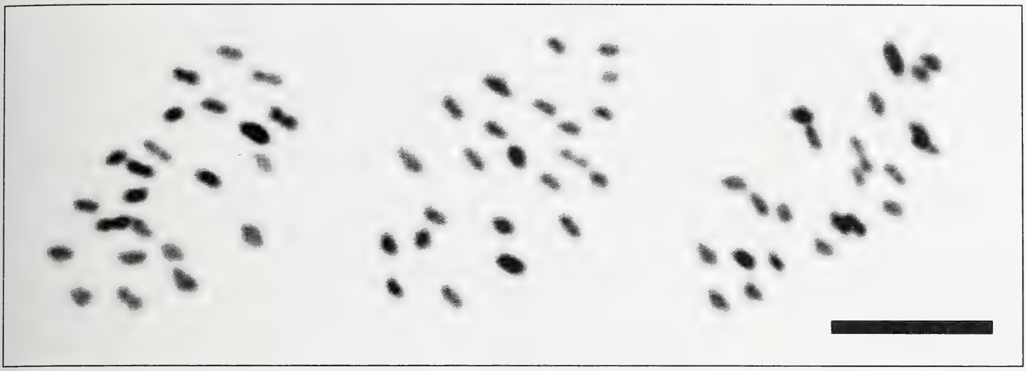


Fig. 23. Karyotype (MI) of *Polyommatus andronicus* ♂, Central Pirin, Popovi Livadi – Orelek, 1600 m, 2.vii.2003, fixation No ZK0303. Scale bar = 10 μm.

either already begun or was just beginning in early July 2003. The emergence of Pirin *P. andronicus* begins clearly earlier that most of the above species excluding *P. escheri dalmatica*. Thus, although for now I assume that the Pirin *P. andronicus* develop in a single generation, as concluded by Coutsis & Ghavalas (1995), I cannot exclude the possibility that a second, perhaps only partial, generation can develop in particularly favourable years at lower altitudes (1500–1600 m). I have found such partial second generation for *P. artaxerxes* and *P. escheri dalmatica* in the second half of August at lower altitudes in Rhodopi (unpublished data).

Most specimens of *P. icarus* collected by myself on Pirin, as mentioned above, are second-generation specimens though their condition is variable. On average, however, these are in better condition than the Pirin *P. andronicus*, which shows that their emergence begins somewhat later than the latter. This situation matches well the one outlined by Coutsis & Ghavalas (1995) for sympatric Greek *P. icarus* and *P. andronicus*.

Discussion

Taxonomy. To summarize the above findings, the analyzed sample from central and southern Pirin can be divided into two groups. The butterflies of the '*P. icarus*-like' group occur from 700 m (the lowest studied altitude) to ca. 1850 m, have constantly smaller male and female genitalia, two generations annually, and identical size and external characters than other Bulgarian *P. icarus*. The individuals of the '*P. andronicus*-like' group occur from ca. 1400–1500 m to at least 1950 m (and probably higher), are on average larger than both the former group and other Bulgarian *P. icarus*, have on average a darker male upperside colour and heavier underside spotting, and their male and female genitalia are constantly larger irrespective of the individual's size. These two groups occur syntopically and synchronously between 1500 and 1850 m. The correlated differences in external and genital morphology, voltinism and altitudinal range displacement with partial syntopy and synchrony between the 'Pirin *P. icarus*' and 'Pirin *P. andronicus*' represent exactly the same situation as that

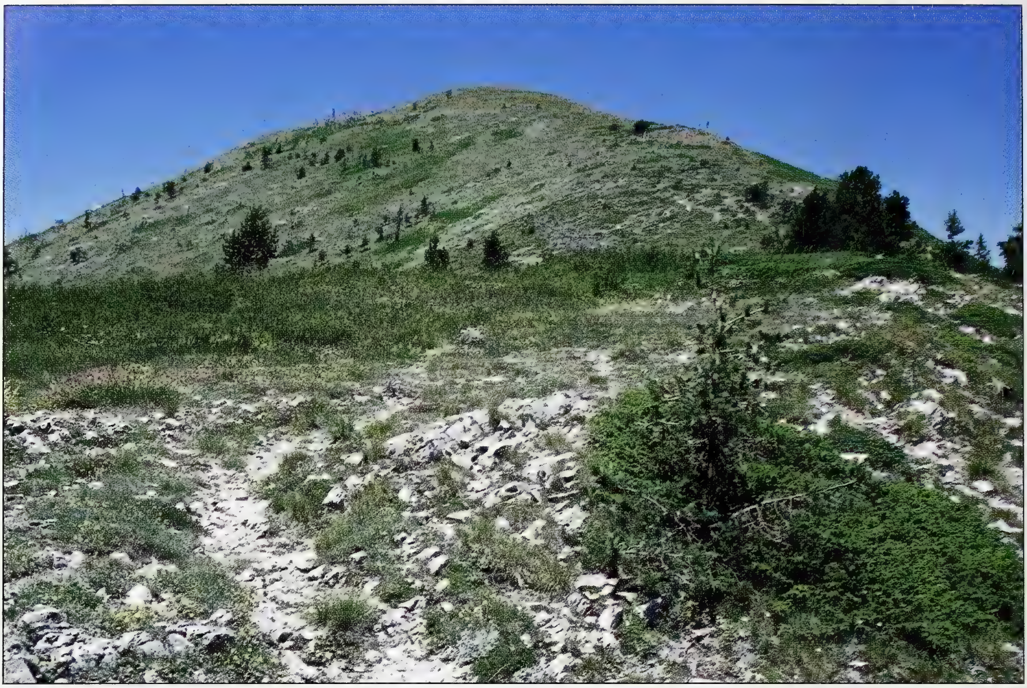


Fig. 24. Habitat of *Polyommatus andronicus* and *P. icarus* above the tree line at ca. 1850 m in South Pirin (in the background is Sveshtnik peak, 1975 m), 3.vii.2003.

described for Greek *P. icarus* and *P. andronicus* by Coutsis & Ghavalas (1995). The only explanation for the observed phenomenon is that the two groups of butterflies up till now referred to as 'Pirin *P. icarus*' and 'Pirin *P. andronicus*' do indeed represent two specifically distinct entities: respectively, the ubiquitous *P. icarus* and the montane *P. andronicus*. Hence, the results presented here confirm the conclusions of Coutsis & Ghavalas (1995). On the other hand, it is found that differences stated by Coutsis & Ghavalas (1995) in external characters such as forewing shape, upperside colour in males, and underside pattern are too variable to be reliable identification markers. In addition, there are no differences between the karyotypes of the two species.

In reality, what is traditionally known as the widespread Palearctic species *P. icarus* is a complex of an unknown number of specifically distinct taxa, of which *P. andronicus* is only one. Another possibly distinct species is the taxon *P. tumangensis* Im, 1988 from North Korea and the Russian Primorye. This taxon is larger than *P. icarus* (forewing length up to 19 mm) and is univoltine (Gorbunov 2001: 142–143), thus representing, in a very superficial sense, an 'equivalent' of *P. andronicus*. From a European perspective a recent molecular study (Wiemers 2003) revealed that "while populations [of *P. icarus*] from Spain to Iran appear as a monophyletic group (including the Greek *Polyommatus andronicus* Coutsis & Ghavalas, 1995 which has been separated only recently from *P. icarus* based on disputable evidence), the Moroccan specimen of *P. icarus* is placed outside this clade. This result came as a surprise because Northwest African populations of *P. icarus* are thought to represent the same subspecies as in Europe [...]. The COI and ITS-2 p-distances between the Moroccan and Eurasian populations of *P. icarus* differ to

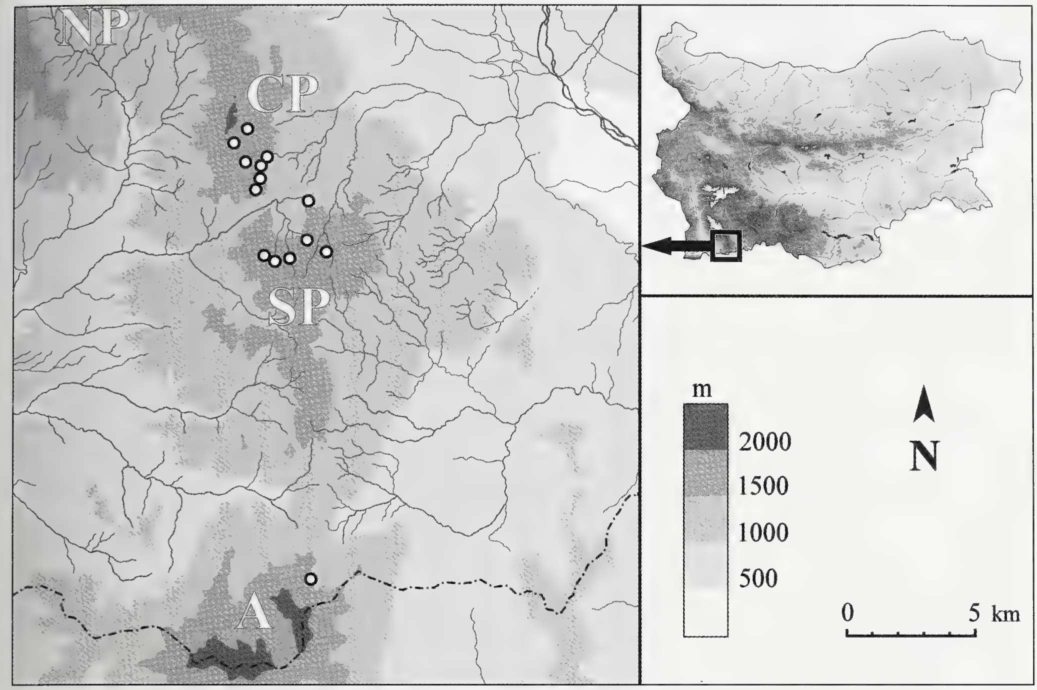


Fig. 25. Known localities (white-centered circles) of *Polyommatus andronicus* in Bulgaria. **A.** Alibotush. **SP.** Southern Pirin. **CP.** Central Pirin. **NP.** Northern Pirin.

a much higher degree than in other species [...], including those with well differentiated subspecies in Northwest Africa (like *Polyommatus amandus*), and are on the level of well differentiated species. The Moroccan specimen also differs in phenotype from the other *P. icarus* (f. celina Austaut), but *P. icarus* is an extremely variable species throughout its vast, trans-Palaearctic distributional range. Without further material it cannot be decided if Northwest African populations of *P. icarus* are so divergent from Eurasian ones that they should better be seen as representing a distinct *Polyommatus* species."

It would seem that the molecular data obtained by Wiemers disprove conclusively the taxonomic distinctness of *P. andronicus*. However, I do not see this to be the case. The observed morphological and genital differences between partly sympatric and syntopic *P. icarus* and *P. andronicus* in both Greece and Bulgaria agree entirely, and it is impossible to explain these in any other way than by accepting the existence of two biological species – no matter how closely related genetically. There is little doubt that the species status of *P. andronicus* is justified. This situation is a good reminder that genetic distances provide a measure on relatedness, not a straightforward indication of taxonomic status, and also exposes the risks inherent in basing taxonomic decisions on results from limited DNA sequences. If anything, then, the DNA data available so far should make taxonomists scrutinize more closely what is currently known as '*P. icarus* s. str.' (excluding *P. andronicus*), as several good species can be expected to exist within this taxon, even inside the western Palearctic. Further DNA studies on this complex, involving COII sequences as well, are most desirable. It is worth remembering that, beside *P. andronicus*, three other species-level taxa very similar to *P. icarus* were described from Europe in recent years: *P. abdon* Aistleitner & Aistleitner, 1994 from Southern Spain, and *P. elena* Stradomsky & Arzanov, 1999 and *P. neglectus* Stradomsky & Arzanov, 1999 from the steppes of easternmost Europe. All of these are presently considered synonyms of *P. icarus* (Kudrna 1996; Tshikolovets 2003), and due to lack of material it has not been possible to reassess their status here. However, several circumstances of interest must be noted with respect to the latter two taxa. Stradomsky & Arzanov (1999) reported that *P. elena* and *P. neglectus* are sympatric and syntopic with *P. icarus* while showing differences in genital structure. Particularly remarkable is the sclerotization pattern in the female genitalia which differ drastically from what I have myself observed in females of Bulgarian *P. icarus* and *P. andronicus*.

The only character that could not be evaluated in the present study is the difference between *P. icarus* and *P. andronicus* in the UV-reflective pattern of the wing underside reported by Coutsis & Ghavalas (1996). Such differences are perhaps of little taxonomic significance. The quantity of UV-reflected pigments stored in the wings of *P. icarus* is heavily dependent on the flavonoid content of the legume plant parts eaten by the larvae; inflorescences are richer in flavonoids than leaves of the same plant, and in laboratory rearings it is possible to vary the UV-reflectivity of *P. icarus* individuals by varying the larval diet (Burghardt et al. 1997). Thus, the differences observed by Coutsis & Ghavalas (1996) could have been induced by differing larval diets of syntopic *P. icarus* and *P. andronicus*, the latter feeding predominantly on inflorescences. This might indicate that in conditions of syntopy these two taxa prefer different parts of the same plants, thereby reducing competition for a common food resource.

Ecological preferences of *P. andronicus*. This is a xeromontane species that prefers flowery rocky habitats between 1000 and 1950 m (Fig. 24), possibly reaching up to ca. 2100 m (see above). All known localities are on partly karstified Proterozoic marble of the Dobrostan formation (Zagortchev 1995). The larval host plant remains unknown.

My detailed observations in Pirin show that there is an altitudinal displacement between the two species. While *P. icarus* barely reaches above the tree line (just as in other Bulgarian mountains), *P. andronicus* inhabits also higher, subalpine habitats considerably above the tree line, including barren karst terrain. In Pirin the two species occur together over most of the altitudinal range of *P. andronicus*, 1500–1850 m. This, however, may be a relatively recent development brought about by human interference with the natural succession of the vegetation. I observed the highest density of *P. andronicus* (including all females seen and a pair in copula) in southern Pirin on the slopes of Sveshtnik peak above the tree line (between 1800 and 1950 m). Only a few males were recorded below that altitude, invariably flying rapidly along narrow dirt roads in otherwise contiguous dense coniferous forest. In central Pirin most butterflies were found in sheltered, sunny flower-rich roadsides along the road leading to Orelek, at altitudes of 1500–1600 m. In both central and southern Pirin all habitats currently utilized by *P. andronicus* between 1500 and 1750 m owe their existence to human activities that have led to disruptions in the forest cover.

Therefore the primary post-glacial habitat of *P. andronicus* under a natural vegetational succession appears to have been flowery subalpine grassland on stony calcareous ground at and above the natural tree line, i.e. higher than 1700–1800 m (Fig. 24). This is supported by the difference in the lowest altitude at which *P. andronicus* occurs in Greece (1000 m: Coutsis & Ghavalas 1995) and Bulgaria (central and southern Pirin: 1500 m, Alibotush: ca. 1400 m, but based on only one specimen). From these numbers it appears that in Bulgaria *P. andronicus* does not reach as low as in Greek mountains. A possible reason for this can be fact that in Greece *P. andronicus* finds even more favourable conditions for downward dispersal on account of Greek mountains being on the whole much more deforested than Bulgarian mountains (Coutsis & Ghavalas 1991; Polunin 1997). My observations in southern Pirin suggest that males of *P. andronicus* in particular can fly long distances down into the forest using man-made ‘corridors’ such as roads. It is also certain that these human activities must have also facilitated the simultaneous *upward* dispersal of *P. icarus*, thereby enhancing the contact between the two species.

Range and conservation status of *P. andronicus*. The newly discovered Bulgarian localities (Fig. 25) significantly expand the total distribution of *P. andronicus*. This Balkan endemic is now known to be restricted to several massifs clustered in a small area between the valleys of Struma/ Strimon and Mesta/ Nestos. In my opinion there is little chance of any further significant additions to the known range of this species. One further region deserves attention in this regard, namely the karst section of northern Pirin below Vihren peak. At ca.1800–2000 m in the vicinity of ‘Vihren’ chalet there are karstified marble slopes with xerophylous plant communities dominated by sparse *Pinus heldreichii* stands that are similar to the communities found at that altitude on Alibotush (pers. observ.). As was said above, *P. andronicus* has successfully adapted to secondary, man-made habitats and has thus managed to considerably expand its altitudinal range in the historical past. That having been said, this species does nevertheless have a very limited range and should probably be regarded as ‘Vulnerable’ and of high conservation interest on a European scale.

Conclusion

The present study provides independent and full support to the conclusions of Coutsis & Ghavalas (1995) regarding the specific distinctness of *P. andronicus*. This is so far the only known sibling species of *P. icarus* in Europe and, what is especially interesting, the two occur in partial syntopy and synchrony. This offers good opportunities for research on the ecology of both species.

The significance of the morphological characters of *P. andronicus* was re-assessed and the conclusions of Coutsis & Ghavalas (1995) are largely confirmed. However, I found that the male upperside colour and forewing shape are too variable in both *P. andronicus* and *P. icarus* to present reliable differences. *P. andronicus* is found to be an even larger species than originally described, with the forewing of the largest Bulgarian specimens measuring 19.5 mm (male) and 18.6 mm (female).

The Bulgarian localities reported here expand considerably the known distribution of this Balkan endemic. My observations on its habitat preferences and altitude range in Bulgaria lead me to conclude that in the historical past this species has apparently benefited considerably from human activity (deforestation, road building) allowing it to expand its range to lower, previously heavily forested, regions. A ‘Vulnerable’ status is nevertheless considered justified in the light of its very limited total range.

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A new species of *Meharia* Chrétien, 1915 (Cossidae) from the Lower Volga Region

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Abstract. *Meharia scythica* sp. n. is described from the Astrakhan Region of Russia. A diagnosis of the genus *Meharia* Chrétien, 1915, is given, here listed for the first time from Russia and Europe as a whole. The holotype of the new taxon is kept in the collection of the entomological Museum of Thomas J. Witt (Germany, Munich).

Zusammenfassung. *Meharia scythica* sp. n. wird aus Rußland, Astrakhan Gebiet, beschrieben. Von der Gattung *Meharia* Chrétien, 1915, hier erstmalig für Rußland sowie Europa nachgewiesen, wird eine Gattungsdiagnose gegeben. Der Holotypus der neuen Art wird in der Sammlung des entomologischen Museums Thomas J. Witt (München) deponiert.

Резюме. С территории Астраханской области России описан *Meharia scythica* sp. n. Дан диагноз рода *Meharia* Chrétien, 1915, впервые отмечаемого для территории России и Европы в целом.

Key words. Lepidoptera, Cossidae, *Meharia*, new species, Russia, Volga Region.

Introduction

A small sample of remarkable cossid moths was collected in August 1996 in the Akhtuba District of the northern Astrakhan Province (the Lower Volga Region of Russia) near Baskuntschak Lake by the senior author. The moths were later identified by the junior author as an undescribed species of primitive cossids of the genus *Meharia* Chrétien, 1915. Taking into consideration that this genus is for the first time noted from Russia and is absent from the Key for the European part of the country (Zagulajev 1978), a description of the new species and a diagnosis of the genus are given below.

Meharia Chrétien, 1915 was established in the Tineidae as a monotypic genus for *Meharia incurvariella* Chrétien, 1915 with type locality Biskra, Algeria. Later, this species was considered conspecific with *Alavona semilactea* Warren & Rothschild, 1905. In 1951, the genus was transferred to the Cossidae by Bradley (1951: 178).

Blalia vittata Rungs, 1943, the type species of *Blalia* Rungs, 1943, described from Sahara, Morocco, is a junior synonym of *M. incurvariella*. Therefore, *Blalia* is a junior subjective synonym of *Meharia* (Fletcher & Nye 1982).

The species of the genus are mostly very similar, apart from color pattern. The mesepimeron is rather triangular and lacks a pale band; the labrum has more or less developed pilifers; the pronotum is low; the metascutum is medially wide; the metascutellum is medially wide and more or less antero-medially extended; tergite I is membranous in its anterior half; the parepisternum anteriorly is well separated from basisternum II; the upper parepisternal suture is set diagonally over pre-episternum II; the mesomeron is slightly narrower than eucoxa II; eucoxa III is wide; the midtibial spurs are located at or slightly beyond the middle of the tibia;

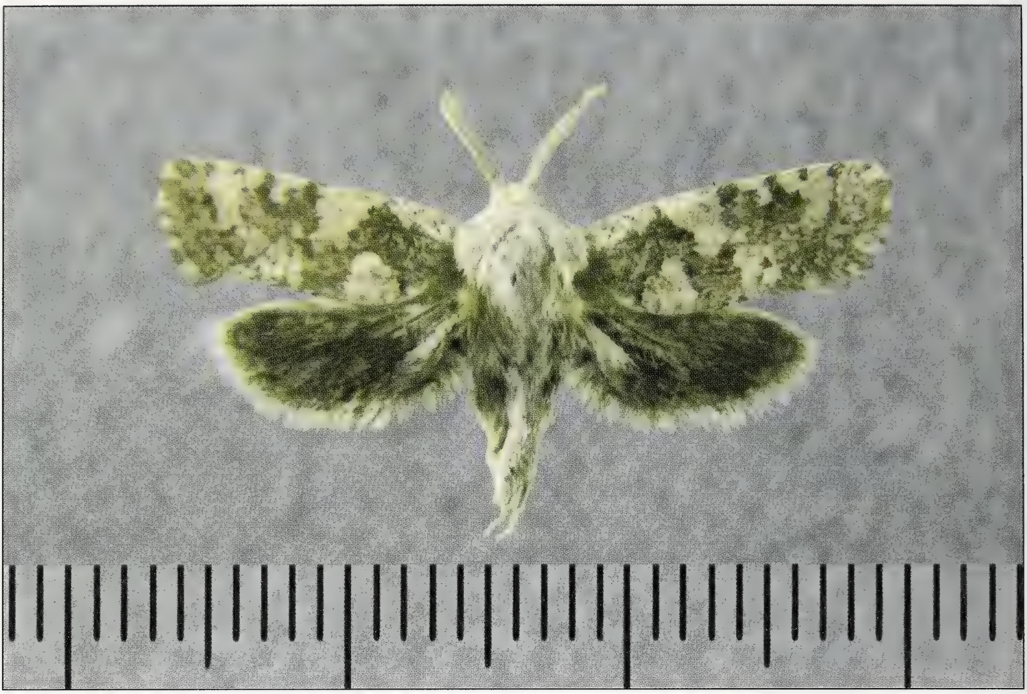


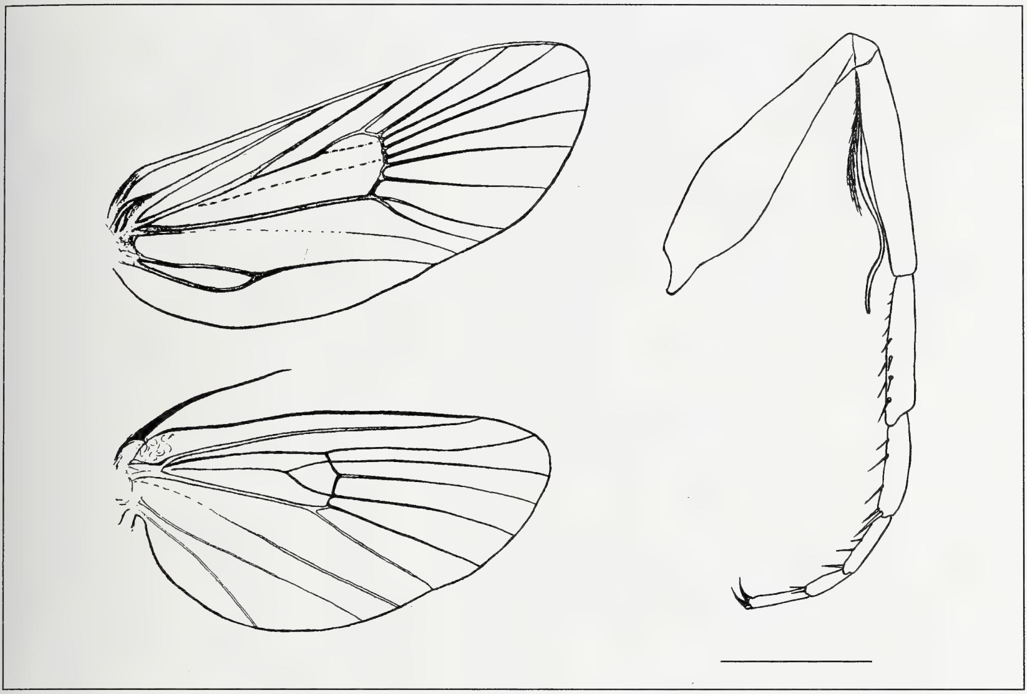
Fig. 1. *Meharia scythica*, holotype ♂.

the fifth tarsomere is approximately 0.8 times the length of the fourth; the forewing is widened at about one-third of its length; CuA2 in the forewing is very distal; the costal region of the hindwing is narrowing very distally; and the anal plate is long. Because of these characteristics, *Meharia* was excluded from the Cossidae, but not attributed to any family by Schoorl (1990: 244). However, in our opinion *Meharia* is considered to be part of the Cossidae. Knowledge on the peculiarities of the preimaginal stages would be especially interesting to define its phylogenetic relationships more precisely.

Meharia Chrétien, 1915: 367

Type species: *Meharia incurvariella* Chrétien, 1915: 368, fig. 11, by monotypy.
Blalia Rungs, 1943: 174. Type species: *Blalia vittata* Rungs, 1943, by original designation.

Diagnosis. Small cossids with elegant, long body. Wing expanse 20–32 mm. Eyes nude. Male antennae bipectinate until the apex, with long rami. Proboscis absent. Labial palpus about 1.5 time longer than eye diameter, horizontal; third segment about 3.5 time shorter than second and somewhat directed downward. Legs long and thin, foretibia without spurs but with long band-shaped epiphysis and hair pencil near base; metatibia with two pairs of spurs, the inner ones much stronger. Forewing narrow and elongated, with rounded external margin; pattern of primitive net-like type with lighter



Figs. 2–3. *Meharia scythica*. **2.** Venation. **3.** ♂ fore leg (scale bar 1 mm).

spots or bands on greyish or brownish ground color; stroke pattern elements as typical for the family are absent in *Meharia*. Hindwing without pattern, usually dark colored.

Venation (Fig. 2). Forewing Sc free as well as bases of all 5 R; M2 practically in the middle between M1 and M3; bases of both cubitals free or shortly stalked; A1 weak, distally developed as fold; A2 and A3 anastomosed on distal half but basal fork well developed; R-Cu cell with M branch and additional radial cellula. Hindwing bases of all veins free; three anals developed but A1 present in basal third only as fold; R-Cu cell with well developed, ramified medial branch.

Male genitalia. Simple, with unpaired uncus, cone-shaped gnathos, weakly sclerotized costa on valva and well-developed saccus; juxta as a plate, weakly attached with phallus and bases of valvae; phallus tubular, straight or slightly curved, with distinct sclerotized knob on distal edge, without cornuti but with zones of weak sclerotization on vesica.

Female. Unknown.

Preimaginal instars. Unknown.

Life history. The genus is native to arid (mainly desert, semi-desert and steppe) biotopes, where the larvae probably develop on (?in) roots and bulbs. Moths fly at dusk and first half of night low above the ground and are attracted to artificial lights.

Diversity and distribution. The specific composition of *Meharia* is not completely known. Apart from the new species describing here, the following taxa are known: the type-species *M. semilactea* Warren & Rothschild, 1905 (northern Africa to Arabia and

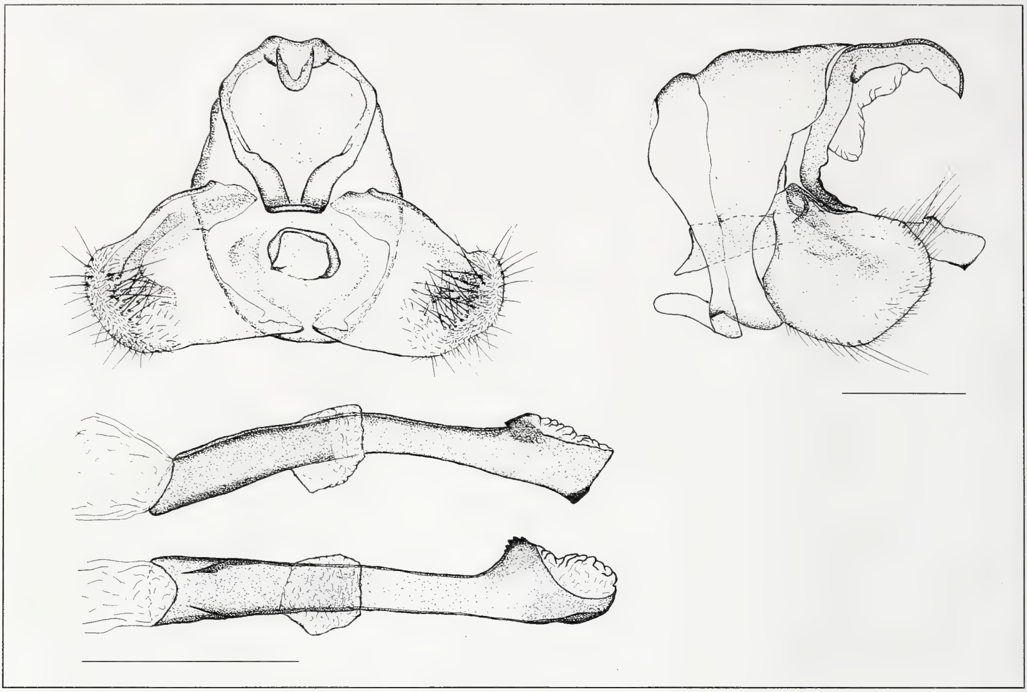


Fig. 4. *Meharia scythica* sp. n., paratype: male genitalia (above, left: caudal view; above, right: lateral view) and phallus shown lateral (above) and dorsal view below (scale bar 0.5 mm).

Iran, with further names introduced for local populations *incurvariella* Chrétien, 1915, *vittata* Rungs, 1943, *persica* Wiltshire, 1946 – their status needs special investigation), *M. philbyi* Bradley, 1952 (Saudi Arabia) and *M. tanganyikae* Bradley, 1952 (Africa, Tanganyika and Tindiga). Validity and rightfulness of the synonymization of the taxa listed above need special investigation. The genus is for the first time here noted from Russia and Europe as a whole.

Meharia scythica sp. n.

Material. Holotype: ♂ [**Russia**] Astrakhan Prov., Akhtuba Distr., passing-track Martovsky, outsk. Bolshoe Bogdo Mt., lum., 21.viii.1996, D. Komarov leg. (coll. Museum Thomas Witt, Munich, later assigned to Zoologische Staatssammlung München). – Paratypes: 3♂, same data, coll. Zoological Institute (St. Petersburg) and coll. D. Komarov.

Diagnosis. This taxon clearly differs from all other species of the genus by the more uniform coloration without contrasting bands and spots as well as by the dark hindwings. The male genitalia can be recognized by the rounded valvae and the weak sclerotization of their costal margins. The only known species from the western Palaearctic, *Meharia semilactea* Warren & Rothschild, 1905, can be separated nicely by the white or whitish transversal bands on the brown ground color in the forewing (de Freina & Witt 1990).

Description. Male (Fig. 1). Head and body with yellowish to cream-colored scales; abdomen darker. Underside with whitish scales; distal edges of abdominal segments ringed with yellowish scales. Forewing length 12 mm. Forewing with dark yellowish-white ground color and darker reddish-brown to greenish-brown scales forming tessellate pattern with prominent basal, anal, and costal spots. Cilia with two rows of scales, the inner reddish with brown tips and the outer, checkered, yellowish and brown. Hindwings dark grey to blackish without pattern, basal field with prominent, whitish bunch of hair-like scales; cilia as in forewing but outer row unchecked, whitish. Venation (Fig. 2) as described for genus. Foretibia (Fig. 3) with long, S-shaped epiphysis and distinct hair bunch at about 2/3 of length.

Male genitalia (Fig. 4). Uncus narrow; valvae short and rounded with weak costa, covered on inner surface with numerous, elongated, strong setae; phallus long, slightly curved, with short dorso-lateral sclerotization.

Habitat. The type-series was collected at light in the Achtuba District of the Astrakhan Province in the vicinity of Baskuntschak Lake (by Bolshoe Bogdo Mt.). The natural vegetation in the area is that of desert steppes dominated by *Artemisia lerchiana*, *Agropyron desertorum*, *Stipa sareptana*, *Festuca valesiaca* s.l., frequently in an assemblage with wormwood (*Artemisia pauciflora*) on saline soils. Predominance of annual and biennial plants (*Descurainia sophia*, *Lepidium perfoliatum*, *Sisymbrium altissimum* etc.) is typical for passing-track Martovsky. Along the railway line, which is directed NNW-SSE, is a rather wide forest belt with a predominance of *Ulmus pumila*. The railway is a path for various weeds and adventive plants growing in appreciable quantities on the embankment. Many of these plants are not native to the area (for example, species of *Papaver*). Five to eight kilometres eastwards from the railroad the unique biotopes of Mount Bolshoe (Large) Bogdo contain significant floristic diversification and a lot of rare plants. In the south-east of the mountain lies an austral karst field (Shar-bulak) with numerous karst gullies, in which *Crataegus ambigua*, *Prunus spinosa*, and *Rosa* spp. can be found.

The climate of the area is sharply continental, droughty. The average precipitation for one year is about 250 mm, but the evaporation is much higher: about 1500 mm. The average annual temperature is +7.7°C. The strong daily and seasonal differences in temperature are characteristic. In summer, the air temperature can rise up to +44°C, while in winter it can go down to -37°C.

Life history. The moths were collected while flying to the light of mercury lamps (250 W). They sat on the ground some distance from the lamp.

Distribution. The species is known only from its type locality – the northern part of the Astrakhan Province of Russia. It undoubtedly has a wider distribution in desert and steppe biotopes of the Kalmyk Republic, Lower Volga, and western Kazakhstan.

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Risk spreading in the voltinism of *Scolitantides orion orion* (Pallas, 1771) (Lycaenidae)

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Abstract. As far as known the Chequered Blue (*Scolitantides orion* (Pallas, 1771)) develops either one or two generations per year. To clarify the voltinism strategy adopted by a population of this species in eastern Germany, we continuously monitored them under natural conditions in 2004. In parallel, breeding-experiments were undertaken in four cages placed within the habitat. Both sets of observations revealed three distinct generations of adults, but only two generations of preimaginal stages were detected per year. The first adults emerged from diapausing pupae in spring. This first generation of adults produced a second generation (the first preimaginals of this season) which developed diapausing as well as non-diapausing pupae. Adults of this second generation again produced diapausing and non-diapausing pupae (the second generation of preimaginals of this season). From the non-diapausing pupae emerged a third generation of adults, which however did not reproduce. The first generation of every year is recruited from all diapausing pupae of the two preimaginal generations of the preceding year. This voltinism is interpreted as a risk-spreading strategy that allows the plastic development of a maximum number of generations during one season. In the study area, the larvae of *S. orion orion* feed exclusively on *Sedum maximum* and the facultatively myrmecophilous larvae were associated with ant species of Formicinae as well as Myrmicinae, but also developed without such an association. Five ant species were identified in these associations, *Formica* (*Serviformica*) *glauca* Ruzsky, 1895, *Lasius* (*Lasius*) *emarginatus* Olivier, 1791, *Tetramorium impurum* (Förster, 1850), *Formica* (*Serviformica*) *fusca* Linnaeus, 1758, and *Camponotus ligniperda* Latreille, 1802, and the first three species are recorded for the first time to be associated with this lycaenid species.

Key words. diapause, plastic voltinism, risk spreading, *Scolitantides orion*, Lycaenidae, facultative myrmecophily, ant species, host plant, *Sedum maximum*.

Introduction

The Chequered Blue (*Scolitantides orion* (Pallas, 1771)) is a Palaearctic species occurring from the Atlantic coast to Japan (Coulondre 1994; Tolman & Lewington 1998). Within this region, the distribution of *S. orion* is a patchy pattern of several disjunct areals, for which six subspecies are recognised: *S. o. orion* from Central and southeastern Europe and Turkey; *S. o. parvula* de Sagarra, 1926 from the Pyrénées and the Iberian Peninsula; *S. o. ultraornata* Verity, 1937 from southern Fenno-Scandia; *S. o. tytleri* Evans, 1924 from Tibet; *S. o. ornata* Staudinger, 1892 from Central Asia to the Far East, and *S. o. jezoensis* Matsumura, 1919 from Japan (Coulondre 1994). In Germany several populations occur in Hesse, Rhineland-Palatinate, Baden-Wuertemberg, Bavaria, Thuringia, and Saxony (Gaedike & Heinicke 1999). *S. orion* is a xerothermophilous species. Populations usually occur in sunny places within mountainous areas, often in river valleys (Settele et al. 1999; Huemer 2004). Despite the fact that *S. orion* is generally well known to lepidopterists certain features of its life history are still insufficiently studied. One controversial issue is the number and phenology of generations per year and these are the main foci of the study presented here. The data available for *S. o. orion* suggest that there are different numbers of generations per year. One generation is stated for populations from Central Europe (Tolman & Lewington 1998), but two are reported for several areas in Switzerland (Tolman & Lewington 1998; Lepidopterologen-Arbeitsgruppe 1994). Forster & Wohlfahrt (1955) generally mentioned two generations for Central Europe but only one at the upper altitudinal limit of the species' distribution in the Alps. Within the Czech Republic two generations were reported from Central Bohemia (Srdinko 1912), but only one from Moravia (Kudla 1951). Two generations are also mentioned from South Tyrol (Huemer 2004). Even within Germany, different numbers of generations per year have been recorded for various regions. While in Rhineland-Palatinate there appears to be only one generation (Reinhardt & Kinkler 2004), a partial second generation occurs in Thuringia (Bergmann 1952), and two generations are recorded from Saxony (Reinhardt 2003). According to Coulondre (1994), voucher specimens of the second generation of *S. o. orion* in insect collections represent only 0–10% of the quantity of the first generation. As many of these data are based on voucher specimens collected in different years, we investigated the phenology in one population in eastern Germany in order to obtain reliable data for an entire season. Observations made on larval host plant use and on their associated ants are mentioned as well.

Methods

The study site is situated to the north-west of Meissen (Germany: Saxony) in a south-facing granite-quarry that is extremely xerothermic on most of its surface. Here large stands of *Sedum maximum* are growing. However, plants like *Humulus lupulus, Rosa canina*, and *Rubus* sp. are encroaching this area and three more *Sedum* species, viz. *Sedum acre*, *S. sexangulare*, and *S. rupestre,* are also present.

Usually, our observations of *S. orion* in this habitat took place every second day, but every day during periods when butterflies were emerging or when a generation was about to be completed. Thus, observations were made on the following days: April 21, 23, 27, 28, 29; May 03, 04, 11, 14, 18, 19, 24, 27, 28; June 01, 03, 04, 07, 09, 11, 14, 15, 21, 22, 23, 24, 25, 26, 28, 30; July 01, 02, 04, 05, 06, 07, 08, 10, 12, 13, 14, 15, 16, 17, 19, 20, 21, 23, 25, 27, 29, 30; August 02, 03, 04, 05, 06, 08, 09, 11, 12, 14, 16, 18, 19, 21, 22, 24, 26, 30; and September 02, 03, 04, 06, 07, 08, 10, 13, 14, 17, 19, 20, 22, 23 2004. No observations were undertaken during strong rains or thunderstorms. At the end of April and the beginning of June the stands of *S. acre*, *S. sexangulare*, and *S. rupestre* were intensively investigated for the presence of eggs and larvae of *S. orion*.

Four cages were installed in the habitat to observe the development of *S. orion* under somewhat controlled conditions. Each cage was composed of two plastic dishes covered by a mosquito net held by willow rods. The measurements for each cage were 60×40×30 cm. The plastic dishes were filled with a mixture of sterilised soil from the quarry habitat and commercial potting soil. One dish of each cage was planted with *S. maximum* from the quarry habitat after the plants had been checked to be free of aphids, thrips, hover fly larvae, and immatures of *S. orion*. The second dish contained different plants: cage 1, 2 and 2a were planted with *Sedum album* from the Dresden

Botanical Garden, cage 3 received only a large stone, and cage 4 a mixture of *S. maximum* and *S. rupestre* from the Dresden Botanical Garden. Between all plants we placed stones of about 8 cm in diameter. The cages were controlled during each visit to the site and were moisturised if necessary. Cages 1, 2 and 3 were installed on April 23. Cages 1 and 2 were covered immediately. Cage 3 was left uncovered until the first eggs were laid on its *S. maximum* plants, which happened until April 27. On April 29 two females of *S. orion* were placed in cage 1 and one in cage 2 for oviposition. In cage 1 all fully developed larvae pupated in places where they could be controlled easily. Thus, all pupal shells could be removed after the adults emerged while generation 3 started to develop. In cage 2 pupation often took place in hidden places. Therefore, after the emergence, copulation, oviposition, and death of the adults of the second generation their eggs were transferred to a new cage called cage 2a, while the pupae of the second generation that had not yet emerged were left in cage 2. Cage 4 was installed on May 19 and one *S. orion* female was put inside the same day. On September 20 all cages were removed and inspected in detail. The remaining pupae were placed in a plastic container on mosses and left outdoor.

Results

Field observations

Flight times in the field (Fig. 1). First generation. Butterflies of the first generation were noted during two months from April 21 to June 21. The first eggs on *Sedum maximum* were found on April 27. No *S. orion* of this first generation flew after June 21, though the weather was sunny, warm, and dry.
Second generation. On July 4 an obviously freshly-emerged adult of *S. orion* was detected. Two butterflies were observed on each of the following four days. The main flight activity lasted between July 12 and August 6. After August 6 the number of observed specimens decreased until August 12, when the last two adults of the second generation were seen, even though the weather was warm and dry afterwards.
Third generation. An obviously freshly-emerged adult of *S. orion* was detected on August 21 and also on August 22. During the following days, the weather was cold and rainy and thus it was impossible to observe any butterfly. At the beginning of September the weather became warm and sunny again and during the hot day of September 4 another adult *S. orion* was seen. This summer-like weather continued until September 17. During this period, three butterflies were observed on September 8 and 10, two butterflies on September 14 and 17, and the last one on September 19.
Host plants of the larvae. The larvae were found exclusively on *Sedum maximum*, though congeneric *S. acre*, *S. rupestre*, and *S. sexangulare* were also present in the study area.
Association with ants. *S. orion* larvae were observed in association with four species of Formicinae ants: *Camponotus ligniperda* Latreille, 1802, *Formica* (*Serviformica*) *fusca* Linnaeus, 1758, *Formica* (*Serviformica*) *glauca* Ruzsky, 1895, and *Lasius* (*Lasius*) *emarginatus* Olivier, 1791.

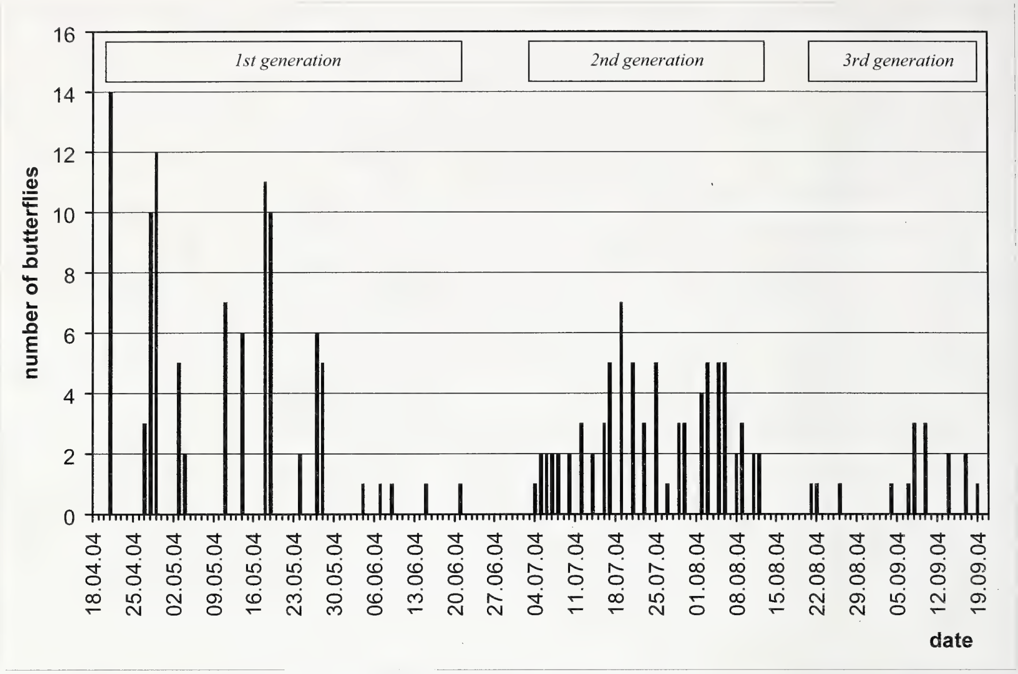

Fig. 1. Number of adult *S. orion* in the study area during 2004. Double counts cannot be excluded because specimens were not marked.

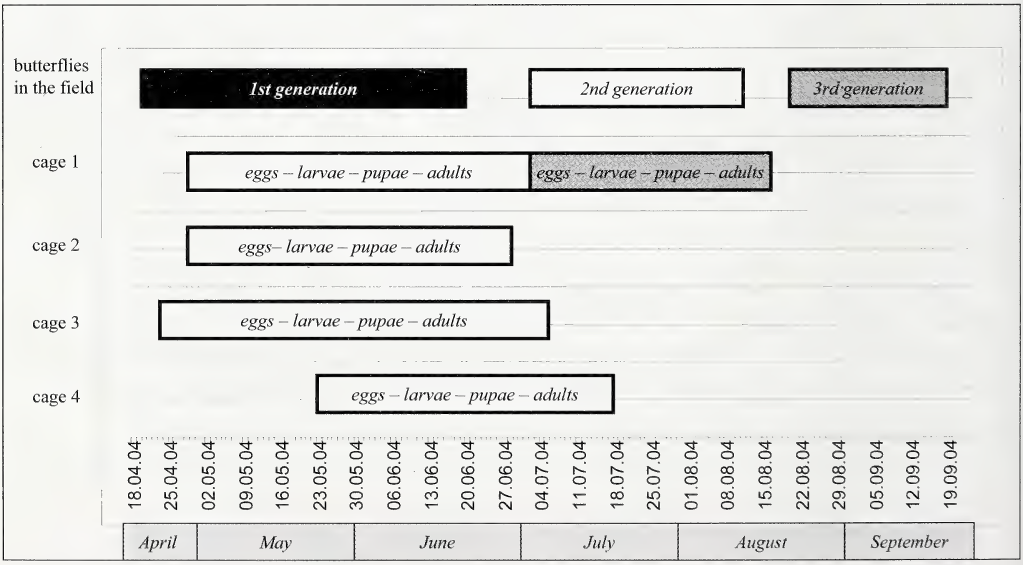

Fig. 2. Phenology of *S. orion* in cages in relation to flight periods in the field. Each bar for each cage starts with oviposition and ends with butterfly emergence. Development until the third generation was completed in cage 1 only (black bar: first generation; white bars: second generation; grey bars: third generation).

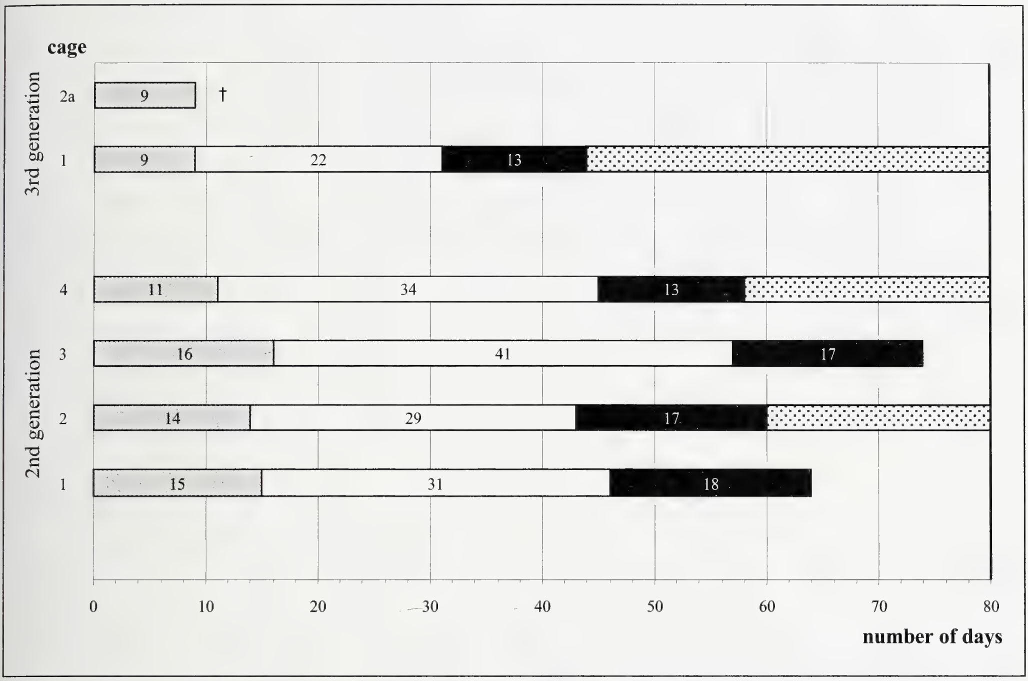

Fig. 3. Duration of development of the preimaginal stages of *S. orion*. Grey bar: egg stage; white bar: larval stages; black bar: non-diapausing pupae; black and dotted bar: diapausing pupae. The right edge of the black bars also indicates the beginning of the emergence of the adults.

Observations in cages **Figs. 2, 3**

Cage 1. Development of the second generation. On May 3 we found the freshly-laid eggs of the two *S. orion* females that had been inside the cage since April 29. All 17 eggs were laid on *Sedum maximum*, though *S. album* was present too. Eight larvae developed to the pupal stage, from which six adults emerged on July 3 and subsequent days. The remaining two pupae did not emerge, but died and were removed later. The development of eggs required about 15 days, whereas the development of larvae took about 31 days and the development of pupae about 16 days. All adults emerged within three days. The entire developmental period of the second generation lasted about nine weeks. After the larvae became seven millimetres long, they were associated with *Lasius emarginatus* until the pupal stage. Since it was possible to find all pupae, cage 1 was used to study the development of the following generation also.

Development of the third generation. The butterflies of the second generation emerged on July 3 and the first copulation was observed on July 4. On July 5 the first eggs were found on *S. maximum*. Again *S. album* was not used for oviposition. Subsequently, nine larvae developed to the final stage. The larvae were first visited by *L. emarginatus* when they were about four millimetres long. Egg development required about nine days whereas the development of larvae took about 22 days and that of pupae about 13 days. At that time it was impossible to detect the pupae without taking apart the entire cage. On August 18 emerged the first adult of the third generation after a development from egg to adult of about 44 days. This butterfly remained alone and finally died between August 27 and 29. When the cage was inspected in autumn two live pupae were found hidden deeply in the plastic dish. However, six other pupae were not found.

Cage 2 and 2a. Development of the second generation. The female placed inside this cage laid eggs that we found on May 3. 40 eggs were attached to *Sedum maximum,* but 17 eggs also on *S. album.* L1-larvae were mining inside the leaves of the latter plant species but all of them died. 15 L1-larvae developed on *S. maximum,* feeding on the youngest leaves at the tip of the plants and after pupating from June 13 onwards. After some of the *S. maximum* plants had been totally defoliated by the feeding larvae three of the full-grown larvae continued feeding on *S. album.* However, after adding two *S. maximum* plants they returned to this food source. Finally, five pupae were detected only, but seven imagines emerged between June 30 and July 4. The inspection of the cage on September 20 revealed only one live pupa. Thus, seven individuals from the original 15 L1-larvae were missing at the end. Egg development required about 14 days whereas the development of larvae took about 29 days and the development of non-diapausing pupae about 16 days. The adults emerged during three days. The entire time of development lasted 8.5 weeks. *Tetramorium impurum* (Förster, 1850) ants were present when L1-larvae emerged, and first associations were observed one day later. Workers of *Formica glauca* were observed for the first time inside the cage and in association with the larvae when these reached 10 millimetres long.

Development of the third generation. On July 2 the first *S. orion* eggs were found on newly added *S. maximum* plants. No eggs were laid on *S. album.* The plants with the eggs were then transferred into cage 2a where larvae emerged after nine days. A thunderstorm destroyed this cage on July 20 and all larvae were lost.

Cage 3. Development of the second generation. On April 27 the first *S. orion* eggs were found on *S. maximum* plants in this still open cage. Eggs were laid between April 23 (day of installation of cage during cold and rainy weather) and April 27. Larvae emerged after 16 days, pupated after 41 additional days, and the pupal stage required about 17 days. Thus, the entire period from egg to adult comprised about 74 days. On June 21 two of the full-grown larvae drowned in a little puddle that formed after three days of rain. On July 8 one imago emerged while a pupae was found dead. 17 days after the emergence of larvae the first ants were detected inside the cage. At that time, the larvae already had a length of nine millimetres. *Formica* (*Serviformica*) *fusca* was the first ant species to be observed in a clear association with the *S. orion* larvae. One week later workers of *Tetramorium impurum* were found also. They were temporarily seen together with workers of *F. fusca* on the same shoot of a *S. maximum* plant but always at different *S. orion* larvae. Breeding was not continued in this cage.

Cage 4. Development of the second generation. The *S. orion*-female placed in this cage lived for 11 days, from 19 until 30 May. Oviposition took place during six days and resulted in 84 eggs, three on one *S. maximum* shoot, 61 eggs on another, and 20 eggs on a third shoot. No eggs were found on many other available *S. maximum* shoots. Larvae emerged after 10 days, developed for 34 days, and the pupal stage lasted 13 days. The first adult emerged on July 21 and died on July 28. A second adult emerged on July 30 and died on August 2. These two adults died without reproductive success. On August 6 two other dead butterflies with undeveloped wings were detected. There was no more emergence. Developmental time from egg to adult took about 58 days. During the inspection of the cage on September 20, 21 living pupae were found. After all *S. maximum* plants became leafless many full-grown larvae continued feeding on *S. rupestre*, but returned to *S. maximum* when this plant species was provided again. No ants visited this cage.

Spring 2005. Altogether, 24 diapausing pupae survived the winter of 2004/2005. The adults emerged in late April 2005.

Discussion

This study focuses mainly on the phenology and voltinism of *S. o. orion*. It was especially important to have a high rate of field observations to detect the short, but clear breaks in flight activity between generations and to avoid misinterpretations resulting from bad weather conditions with no flight activity. Our continuous observations in the field as well as in cages show clearly that *S. o. orion* developed three generations in the study area during 2004.

So far as we could verify, previous reports of one or two generations per year were derived from single observations or collection specimens, but not from continuous observations of the development of individual specimens in the field. Moreover, Reinhardt (2003), Reinhardt & Hardtke (2003), and Reinhardt & Kinkler (2004) constitute their interpretations on samples of adults from small areas, but amalgamate samples from different years to one hypothetical year. Thus, these authors could not recognise the short interruptions in the flight activity between generations of *S. o. orion* because the phenology varies too much between years. Furthermore, the samples analysed from Saxony by Reinhardt (2003) and Reinhardt & Hardtke (2003) did not comprise voucher specimens from the entire period during which the adults of *S. o. orion* are on the wing.[1]

The development of three generations in the study area might be correlated to local circumstances and thus can not necessarily be generalised. We assume that the variable numbers of generations per year reported in the literature (Kudla 1951; Bergmann 1952; Forster & Wohlfahrt 1955; Henriksen 1982; Koch 1984; Tolman & Lewington 1998; Reinhardt 2003; Huemer 2004; Reinhardt & Kinkler 2004) are related to altitude and latitude of the habitats, and thus to different ecological conditions, i.e. temperature and length of growing season. These abiotic factors are well known to influence the developmental rate (Fischer & Fiedler 2002) and dormancy (Müller 1992) of insects. Thus, all data available suggest that *S. orion* has a plastic developmental strategy depending on local climatic conditions.

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[1] It is anecdotal that lepidopterists from Dresden and its vicinity traditionally visit the *S. orion* habitats along the right edge of the Elbe during May since decades, combining their excursions with a visit in the nearby restaurants to enjoy the Asparagus season. Thus, voucher specimens from this area well represent the first generation, but significantly less so for subsequent generations.

However, our study on *S. o. orion* did not compare the influence of, e.g. temperature in different populations. Instead, one population was investigated at a very restricted location and thus it can be assumed that all specimens observed were influenced by abiotic factors in the same manner. Besides the fact that *S. o. orion* develops three generations the synchronous development of diapausing and non-diapausing pupae in the second as well as the third generations is a phenomenon hitherto not recorded in the literature. The factors influencing the development of these diapausing pupae are still unknown since dormancy-inducing exogenic abiotic factors can be excluded at least for the second generation. Müller (1992) refers to the possibility of endogenic factors inducing dormancy in insects in the absence of exogenic dormancy-inducing factors. He calls such a prospective dormancy parapause. However, a prospective dormancy does not explain the coexistent development of diapausing and non-diapausing pupae. The strategy for a genotype to develop both non-diapausing and diapausing phenotypes in one generation is described by Hopper (1999) as "risk-spreading," though the mechanism underlying this risk-spreading and its genetical basis are still unknown. The discovery of this phenomenon in *S. o. orion* was unexpected. Thus, no statistically relevant numbers of diapausing and non-diapausing pupae were noted. However, the fact that this species has the ability for "risk-spreading" guarantees a maximum number of generations per year under the relevant local conditions – and thereby a higher offspring number. Moreover, the ability for "risk-spreading" may explain why only one or two generations are recorded for *S. orion* from areas with shorter vegetation periods as in mountain hills or at more northerly latitudes. It can also explain why a 'partially second generation' is frequently recorded for *S. o. orion* (Bergmann 1952; Coulondre 1994; Lepidopterologen-Arbeitsgruppe 1994).

All observations made in the study area revealed that larvae of *S. o. orion* developed on *Sedum maximum* while all larvae fed with *S. album* died. In contrast, Weidemann (1995) records that *S. orion* develops on *Sedum album* too, but it is questionable whether this record is just taken from Henriksen (1982) who mentions this host plant for *S. o. ultraornata* from Fenno-Scandia. Host plant quality can influence the development of insects, it can also influence diapause and voltinism under constant photoperiod and temperature as shown for *Choristoneura rosaceana* (Lepidoptera: Tortricidae) by Hunter et al. (1996). Such observations pose the question whether the varying voltinism observed for different *S. orion* populations may also depend on the host plant used by the larvae.

In the Elbe valley west of Dresden *S. o. orion* develops new generations as long as favourable conditions exist. Apparently, the third generation appears so late during the season that the adults do not reproduce successfully, but diapausing pupae of the second and third generations guarantee the survival of the population.

Our observations confirm that *S. orion* larvae are steady, but facultatively myrmecophilous, since larvae developed without ants in cage 4 as well. Until now, ant species associated with *S. orion* have only rarely been recorded (cf. Aigner-Abafi 1899; Malicky 1969; Fiedler 1991). In the present study, *Formica* (*Serviformica*) *glauca*, *Lasius* (*L.*) *emarginatus* (Formicinae), and *Tetramorium impurum* (Myrmicinae) were found in association with *S. orion* larvae for the first time. *Camponotus ligniperda* and *Formica* (*Serviformica*) *fusca* have also been observed in association with *S. orion*, which is already recorded by Fiedler (1991) and Saarinen (1995). Anyhow, the attractiveness of *S. orion* larvae for ants appears to be very high because all larvae in the field were found in association with ants. In fact, *S. orion* was one of the earliest European lycaenid species on which the phenomenon of myrmecophily was studied (Ehrhardt 1914; cf. Malicky 1969; Fiedler 1991).

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Neotypus melanocephalus (Hymenoptera: Ichneumonidae): the first record of a parasitoid wasp attacking *Maculinea teleius* (Lycaenidae)

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Abstract. A *Maculinea teleius* (Bergsträsser, 1779) pupa was found near Meszes (NE-Hungary) in a *Myrmica scabrinodis* Nylander, 1846 nest. Some hours later emerged a wasp that proved (det. K. Horstmann) to be *Neotypus melanocephalus* Gmelin, 1790 (Ichneumonidae). The wasp with the exuvium and specimens of the host ant are deposited in the Hymenoptera Collection of the Hungarian Natural History Museum (25.vii.2002; Meszes; leg. A. Tartally). It would be desirable to obtain more *Neotypus* specimens from *M. teleius* pupae to test if the wasp really is *N. melanocephalus*, or a form of *N. pusillus* Gregor, 1940, or even a new cryptic species of *Neotypus*.

Key words. *Neotypus, Maculinea, Myrmica,* Ichneumonidae, Lycaenidae, parasitoid, Hungary.

The larvae and pupae of four of the five European species of *Maculinea* van Eecke, 1915 butterflies are known hosts of parasitoids from the Ichneumonidae family. The two cuckoo *Maculinea* species for which the caterpillars are fed by worker ants (Thomas & Elmes 1998) have *Ichneumon* sp. parasitoids. *Ichneumon eumerus* Wesmael, 1857 was recorded as a parasitoid of *M. rebeli* (Hirschke, 1904) and the same or a sibling *Ichneumon* species attacks *M. alcon* ([Denis & Schiffermüller], 1775) as well (Thomas & Elmes 1993; Munguira & Martin 1999; Sielezniew & Stankiewicz 2004; Thomas, Fitton & Hilpert, pers. comm.). Two of the three *Maculinea* species, of which the caterpillars are predators of ant broods (Thomas & Elmes 1998), have *Neotypus* parasitoids: *N. pusillus* Gregor, 1940 was bred from *M. nausithous* (Bergsträsser, 1779) (Thomas & Elmes 1993) and another *Neotypus* sp. from *M. arion* (Linnaeus, 1758) (Thomas, Wardlaw & Fitton, pers. comm.). So far as known, each of these parasitoids is host-specific to a single *Maculinea* species, but until now no parasitoid wasp of the predatory *M. teleius* (Bergsträsser, 1779) was known.

Maculinea species and their parasitoids are of high interest to evolutionary and conservation ecology because of their extreme adaptations to a myrmecophilous life-style and because all are rare and globally endangered (IUCN 2004; Hochberg et al. 1996; Munguira & Martin 1999). The larvae of these butterflies feed briefly on specific foodplants before being adopted by *Myrmica* ants (Hymenoptera: Formicidae) in which colonies they live as social parasites for 11–23 months (Thomas & Elmes 1998). *Neotypus pusillus* oviposits on young *M. nausithous* larvae on the larval foodplant while *Ichneumon* spp., perhaps in response to the different population structure found in cuckoo species, penetrate *Myrmica* nests to seek *Maculinea* larvae (Thomas & Elmes 1993). These parasitoids both emerge from host pupae inside ant colonies and are presumed to have similar specialisations to those described for *I. eumerus* (Thomas et al. 2002) to escape unharmed from nests.

Between 2000 and 2003, hundreds of *Myrmica* nests at eight sites were examined for caterpillars, pupae, and exuvia of *M. teleius* to measure host specificity and to investigate whether parasitoids of this butterfly occur in the Carpathian Basin, Hungary.

Twenty-four caterpillars, one exuvium, and eight pupae of *M. teleius* were found at five sites. One of the pupae contained a parasitoid. This was collected on 25 July 2002 near the village of Meszes (NE-Hungary; Borsod-Abaúj-Zemplén County) in a marshy meadow with a profusion of *Sanguisorba officinalis* (I intentionally do not give the exact location as a precaution against collectors; only two more pupae were found there but these were not parasitized). The pupal cases of *M. teleius* and *M. nausithous* are hard to distinguish, but this pupa was found in a *Myrmica scabrinodis* Nylander, 1846 nest within one meter from a *S. officinalis* plant. *My. scabrinodis* is the main host ant of *M. teleius* in Europe (Thomas et al. 1989; Stankiewicz & Sielezniew 2002; Tartally & Csősz 2004) and no other species of *Maculinea* nor any other foodplant of *Maculinea*, occur at this site (Varga, pers. comm.). Moreover, *M. nausithous*, the only other *Maculinea* species that uses *S. officinalis*, is not known from NE-Hungary (Bálint 1996). Based on this evidence, this pupa was identified as *M. teleius*. Some hours after collection, a wasp hatched from this pupa. The wasp with the exuvium and specimens of the host ant (*My. scabrinodis*) were placed into a small vial with 75% ethanol. The full sample is deposited in the Hymenoptera Collection of the Hungarian Natural History Museum (25.vii.2002; Meszes; Tartally leg.). The wasp was sent to Dr. Klaus Horstmann (Theodor-Boveri-Institut für Biowissenschaften, Würzburg) for determination; it proved to be *Neotypus melanocephalus* Gmelin, 1790, a species that had not previously been recorded as a parasitoid of any *Maculinea* host (Thomas, pers. comm.).

There are several known *M. nausithous* populations infected by *N. pusillus* that co-occur with *M. teleius* in Europe, but in those studied in the Rhône valley (France), there is strong evidence that *N. pusillus* never parasitizes *M. teleius* (Thomas, pers. comm.). It would be worth checking more widely whether *N. pusillus* uses only *M. nausithous* as a host or whether it can infect *M. teleius* too. This is important because *N. melanocephalus* has, at times, been synonymised with *N. pusillus*; but current studies in the EU 'MacMan' programme suggest that *N. melanocephalus* is a cryptic sibling species (Thomas, pers. comm.), a phenomenon well known in parasitoid taxa (Godfray 1994). It would be desirable to obtain more *Neotypus* specimens from *M. teleius* pupae and to test whether this wasp really is *N. melanocephalus*, or a form of *N. pusillus*, or even a new cryptic species of *Neotypus*. If, as I suspect, it is both a good species and specific to *M. teleius,* then, like other parasitoids of *Maculinea,* it will by definition be rarer and more threatened than its host, and its populations will be in greater need of conservation (Hochberg et al. 1996; Thomas et al. 2002).

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The geographic range of *Rhyacionia hafneri* (Rebel, 1937) (Tortricidae)

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Recently, Huemer (2003) redescribed the tortricid moth *Rhyacionia hafneri* (Rebel, 1937) and recorded this species from Slovenia for the first time. Huemer (2003) also illustrated diagnostic characters and discussed the distribution of *R. hafneri* and closely related taxa. It seems that *R. hafneri* is a locally distributed, probably rare submediterranean species. With the exception of the type locality 'Dalmatia – Knin' (coastal Croatia) and records from three localities in Slovenia (Huemer 2003), no other distributional data are available and the life history remains unknown. Referring to Huemer's (2003) diagnosis and additional data provided by Razowski (2004), several additional specimens of *R. hafneri* have now been discovered:

Material. 3♂, 2♀ **Slovenia**, Nanos Mts, Strmec (45°50´N, 14°00´E), 800 m a.s.l., 28.v.2000, Liška leg., Liška & Jaroš coll.; 1♀ **Bulgaria**, foothills of the Rhodope Mts., Asenovgrad (42°00´N, 24°55´E), 300 m a.s.l., 29.v.1984, Jaroš leg. et coll.; 2♀ **Hungary**, Vertés Hills, Csákberény (47°20´N, 18°15´E), 350 m a.s.l., 8.v.2003, Liška leg. et coll.; 1♀ **Czechia**, South Moravia, Ketkovice (49°10´N, 16°15´E), 360 m a.s.l., 28.v.1999, Šumpich leg. et coll.; 1♂ Bílé Karpaty Mts, Čertoryje National Reserve, (48°50´N, 17°25´E), 350 m a.s.l., 5.–7.vi.1997, Šumpich leg. et coll.; 1♀ Moravský kras (Moravian Karst), Olomučany (49°20´N, 16°40´E), 500 m a.s.l., 23.v.2002, Z. Laštůvka leg., Jaroš coll.

All the localities are characteristic limestone habitats. The dominant native pine species of the Slovenia and Bulgaria localities is *Pinus nigra*, which is undoubtedly the food plant of *R. hafneri* there. In the Vertés Hills (Hungary) and the three localities of South Moravia (Czechia) the only native pine species is *P. sylvestris* (but *P. nigra* was introduced into these areas more than 100 years ago and now is quite common). Therefore, it is possible that *R. hafneri* spread to Central Europe when *P. nigra* was planted there by foresters. On the other hand, most localities of *P. nigra* and associated *R. hafneri* in Slovenia, Bulgaria and Croatia are certainly autochthonous (cf. Meusel et al. 1965), but recently *P. nigra* has been extensively planted in all these countries. It is expected that *R. hafneri* will be found also in northern Italy, Austria, Romania and southern Slovakia, where *P. nigra* is also planted by foresters in some regions. Food plant studies and monitoring of the distribution and spread of *R. hafneri* in Europe are badly needed.

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The latest volume of *The Geometrid Moths of Europe* treats the geometrid subfamily Sterrhinae that includes several taxonomically challenging genera, such as *Idaea* and *Scopula*. Although the Sterrhinae fauna of northern Europe is well-known the opposite is true for southern Europe. The taxonomical information of that fauna has been scattered through the literature, which has often not only been inaccessible both to scientists and amateurs, but also dubious because many of the authors have not been aware of work of others. Therefore an identification book that brings together all that knowledge has been long awaited.

The book treats 196 species of Europe and its adjoining countries, including those of North Africa. It proposes 102 taxonomic changes including descriptions of three new species. The book opens with a short introduction to methodological notes, which is followed by a systematic account of taxa. Diagnoses are given for the subfamily, and for the six tribes and 18 genera to which the species are classified. Species' descriptions contain list of synonyms, available and unavailable names. Diagnoses of imagos and genitalia are short, but this is justifiable because descriptions are accompanied with numerous text-figures and photos, which quite easily guide the reader to look into appropriate characters. For each species a distribution map is presented, accompanied with a written description of distribution area. There are separate sections for phenology, biology, habitat, parasitoids, similar species, and if necessary, for remarks. These are followed by high-quality colour plates, depicting a large number of specimens and showing the variation of external features. The plates that contain small species have been enlarged. For each species a drawn picture of male and female genitalia is shown. The book ends with a systematic check-list of European and its adjoining regions' fauna.

The book is designed for species identification and for this purpose it is excellent. The author has examined an impressive number of 300 000 specimens during the preparation of this volume which certainly gives reliability for the taxonomic judgment. Generally, adequate species identification information is easily accessible and problematic taxonomical cases, which need further study, are clearly mentioned. However, there are a few, admittedly minor things, which deserve a note here. The author has decided not to evert vesicae, even though it is a standard procedure in Lepidoptera systematics nowadays, and these structures have already been shown to be of additional diagnostic value in Sterrhinae systematics. The exclusion of this possible source of information *a priori* is unfortunate. Perhaps it could have given more solid evidence for taxonomic decisions in the difficult species groups, such as the Mediterranean *Rhodostrophia calabra*-group, where other diagnostic features are vague. In this genus the vesica characters have already been shown to offer further taxonomical information by others. Regarding genitalia plates, certain female genital structures have systematically been omitted in figures. Taxonomically important structures around the ostium bursae are omitted or weakly shown and position of the ductus bursae in the abdominal sternite is unknown because the latter has been removed from it. Further, the ductus seminalis is not shown in a number of species and in several instances only parts of the genitalia are shown, perhaps as a result of unsuccessful dissection. Also, it would have been useful to reader if the diagnostic features were pointed out in the plates. Another issue is that immature stages are dealt with rather superficially. For a majority of species these are unknown, but descriptions like 'Pupa short, abdomen slender.', as for *Oar*, to cite one example, can barely be considered an improvement when compared with 'Immature stages unknown.' Finally, the book contains several citations to internet pages that offer additional information on taxonomy and biology of the dealt taxa, but when writing this the data were not available. No doubt, when the pages are functional they will offer wealth of further information.

The other part of book, i.e. systematic treatment of taxa, is variable in quality. The taxa are mostly classified according to recent findings, or in the lack recent research, after the traditionally held views. In other instances the author has chosen to favour his own taxonomical expertise. To cite an example, for the generic classification of the Scopulini the author explains well what the recent findings made by other researchers suggest, yet he has chosen not to follow them. The adopted, traditional approach is justified from the point of view of nomenclatoric stability. However, elsewhere, as in the case of *Apostates*, the author proposes novel taxonomic changes with little written justification. In another example the author has failed to make the presented taxonomical decisions easily accessible. Several new species combinations or synonyms are mentioned in the abstract, e.g. synonymy of *Rhodostrophia oxyntis* Prout with *R. xesta* Prout. These non-European taxa are not found in the index because they are not treated in this monograph. By browsing through the book I found the relevant part but there was no additional evidence that could be used to evaluate the conclusion drawn. If the presented taxonomical decisions are not based on transparent evidence, it unfortunately makes results appear suspect even if they are correct.

Despite the comments made above, I wish to emphasise that overall impression of the book is very positive and the author has produced an excellent monograph that is likely to become a standard reference in the field. The book contains a huge amount of taxonomic and biological data and I consider it a must for anyone who is interested in the European Sterrhinae fauna.

PASI SIHVONEN

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Abstract. *Carcharodus alceae* is one of the most common and best known of the European hesperiids; its Malvaceae host-plant family was already known to Esper in the 18th century. *Chrozophora tinctoria* (L.) Raf. (Euphorbiaceae) was found to be both a new food-plant species and family for this hesperiid. Late-season use of this new host-plant by *C. alceae* may have its disadvantages as the plant does not afford adequate protection for the overwintering pupa. This is the first record of a host-plant for *C. alceae* that does not belong to the mallows; it is also the first record of a Palaearctic hesperiid feeding on Euphorbiaceae. The discovery, the biology of the skipper and the use of euphorbs by other butterflies in the world are presented and analysed.

Key words. *Chrozophora tinctoria*, Euphorbiaceae, host-plant, *Carcharodus alceae*, Hesperiidae, Palaearctic, Israel, Middle East.

Introduction

The species *Carcharodus alceae* was described as "*Papilio alceae*" by Esper in 1780 from Erlangen, South Germany. He named it after its host-plant the "*alcea rosea* ... Gartenmalve" (= *Althaea rosea*), otherwise known as the Common Hollyhock. It became the type species of the genus *Carcharodus* Hübner, 1819 by ICZN's opinion number 270 of 1954.

The butterfly is widely distributed in Southern and Central Europe up to 52°N and stretches eastwards across Turkey, the Middle East, the Caucasus, northern Iran, Turkmenistan, Uzbekistan, Kazakhstan, Afghanistan, and the Altai Mts. to East Siberia. Isolated populations of this Palaearctic skipper exist in the Sinai Peninsula (this is a recent isolation, Dr Rienk de Jong checked the genitalia to find that it is a 'normal *Carcharodus alceae*') and Yemen, as a distinct subspecies *wissmanni* Warnecke, 1934. The closely related *Carcharodus tripolinus* (Verity, 1925) (de Jong 1978), flies in the southern part of the Iberian Peninsula as far north as Murcia province, Spain and about 140 km north of Lisbon in Portugal (de Jong pers. comm.). In North Africa it extends from Morocco eastwards to Tunisia and Libya. Throughout their range, both species have always been associated with Malvaceae host-plants as evidenced by citations in numerous publications. The story is now known to be incomplete with the present record of an additional and exceptional host-plant family, the Euphorbiaceae.

The discovery

In mid-March 1988 a diapausing winter larva of *Carcharodus alceae* was found in Bet Arye, resting in typical fashion inside a folded leaf of *Alcea setosa* (Boiss.) Alef. (Malvaceae). An adult female emerged on 15 April 1988. Subsequently, on 14 May

1988, three eggs were found on small, stellate (star-like), hairy leaves of *Malvella sherardiana* (L.) Jaub. et Sp. (Malvaceae). This prostrate, new host-plant for Israel, appeared in my garden on alluvial soil which was imported from coastal lowlands. The larvae found difficulty in surviving on the small leaves, which did not provide sufficient shelter and, indeed, they all succumbed to parasitic braconid wasps. On 23 July 1988, I found eggs again on *M. sherardiana.* On 6 August 1988, I found small *C. alceae* larvae inside folded leaves of a third host-plant that grew next to the *Malvella* on the same black soil. The greyish leaves were large enough to provide shelter for the growing larvae but, when taken indoors for closer observation, the larvae were seen to reject this foodplant and quite often I found them wandering off the plants looking for other food. None of the larvae survived. Attempts were made to identify this unknown host-plant, which was covered with stellate tiny hairs but had no fruits at the time, it was provisionally considered to be *Glinus lotoides* L. Molluginaceae. (A resting *C. alceae* female was photographed in Cyprus on *Glinus lotoides* (Makris 2003: 272); following my request, Christodoulos Makris tried in late summer 2004 to find larvae of *C. alceae* within leaf pods of *Chrozophora* and *Glinus* plants, but it was too late in the season to find evidence of feeding). On 22 September 1990, a search was made in the public gardens of Bet Arye, where an irrigated area, originally prepared for the planting of flowers but later abandoned, allowed the invasion of various wild plants including various Crucifers, *Echinochloa colonum* (L.) Link, *Malva* sp. and *Chrozophora* sp. A thorough search for larvae ended successfully with one L4 *C. alceae* larva, 15 mm long, found inside a leaf pod on *Chrozophora tinctoria* (L.) Raf. (Euphorbiaceae). On 10 October 1990, the first observed *C. alceae* adult to complete its life cycle on *C. tinctoria* emerged successfully. It is important to note that the neighbouring *Malva* was devoid of larvae and that *Chrozophora* was apparently preferred as a host-plant.

No other butterfly is known to feed on this newly discovered Euphorbiaceae host-plant and thus *C. alceae* becomes the first butterfly (Rhopalocera) reported to feed on *Chrozophora tinctoria* (Robinson et al. 2004; Fiedler 1991 & pers. comm.).

The life history of *Carcharodus alceae*

The species is on the wing in Israel from February in the Negev until November in the Mediterranean region. In the South Sinai Massif it flies from March until September, and in Mt Hermon from the end of May at 1500 m to July-August at 2000 m. It has up to three annual broods depending upon the elevation above sea level and availability of host-plants.

Eggs and laying preferences. Eggs are laid singly on both surfaces of the leaves of *Alcea setosa*, its most common host-plant in Israel. The egg is brown when laid and is 0.75 mm in diameter and 0.6 mm high. Its spherical surface is covered with relatively few but tall bulges that may provide partial protection from parasites. These nodes converge upwards to create five prominent ridges, the tops of which circle the depression of the micropyle. Its typical texture, with a "flower" of 8–9 "leaves" around the micropyle is shown on Fig. 2. In mid-September 2004 three types of hollyhock were growing in my garden: 1) Wild, 2) Hybrids of wild x cultivated, and 3) Cultivated. Eggs

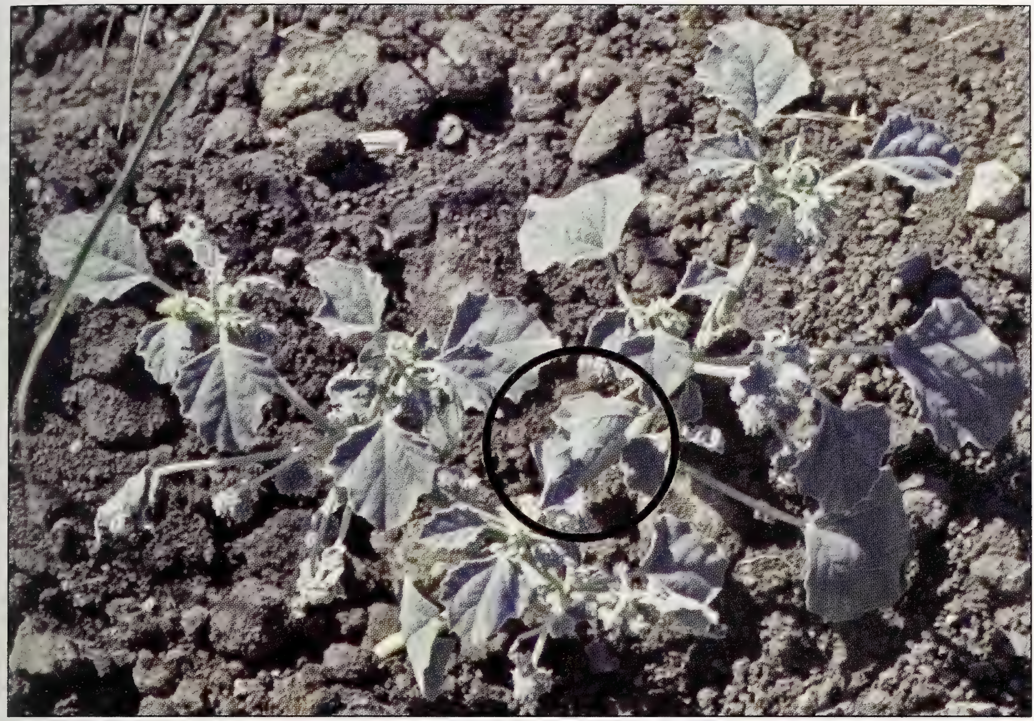


Fig. 1. *Chrozophora tinctoria*, the new host-plant of *Carcharodus alceae* at Kibutz Haogen, Hasharon district, Central Coastal Plain, Israel, 19.ix.2003 (circled: a leaf pod of *C. alceae* larva).

were laid only on the wild plants, at the base of the dry flower stalks where few green leaves still existed. The females totally ignored the other *A. setosa* plants which carried fresh and larger leaves. Only when the few leaves of the wild plants were consumed did the females start to lay on the hybrids. The cultivated *A. setosa* were not visited by any female and remained unused. It is quite astonishing that the *C. alceae* females could sense exactly, and with no mistake, which plant they preferred. Does it mean that these three types of plants are chemically different?

Larvae. The young larva hatches usually after five to seven days; it opens a hole in the upper side of the egg by cutting around and lifting the "flower" mark. It does not consume the egg shell and immediately cuts and/or folds a leaf to prepare its sheltered leaf pod (Figs. 1, 3, 4). It is 2 mm long, light green with short hairs, with a black head and a reddish "collar" behind the head. It grows to about 23 mm long and at this stage of development its body is whitish-green with bright short hairs. The head remains black and is covered with tiny brown and yellow setae, the "collar" is black with three yellow spots (Fig. 5). In mid-summer a larva which hatched on 22 July pupated 24 days later, on 15 August.

In July 1979 I bred, simultaneously, larvae from the isolated population around Santa Katarina Monastery, 1600 m, in the Southern Sinai Massif and from Yahud (10 km east of Tel Aviv, Israel, elev. approx. 100 m). I noticed slight differences in larval coloration; the Sinai larvae were usually much brighter.

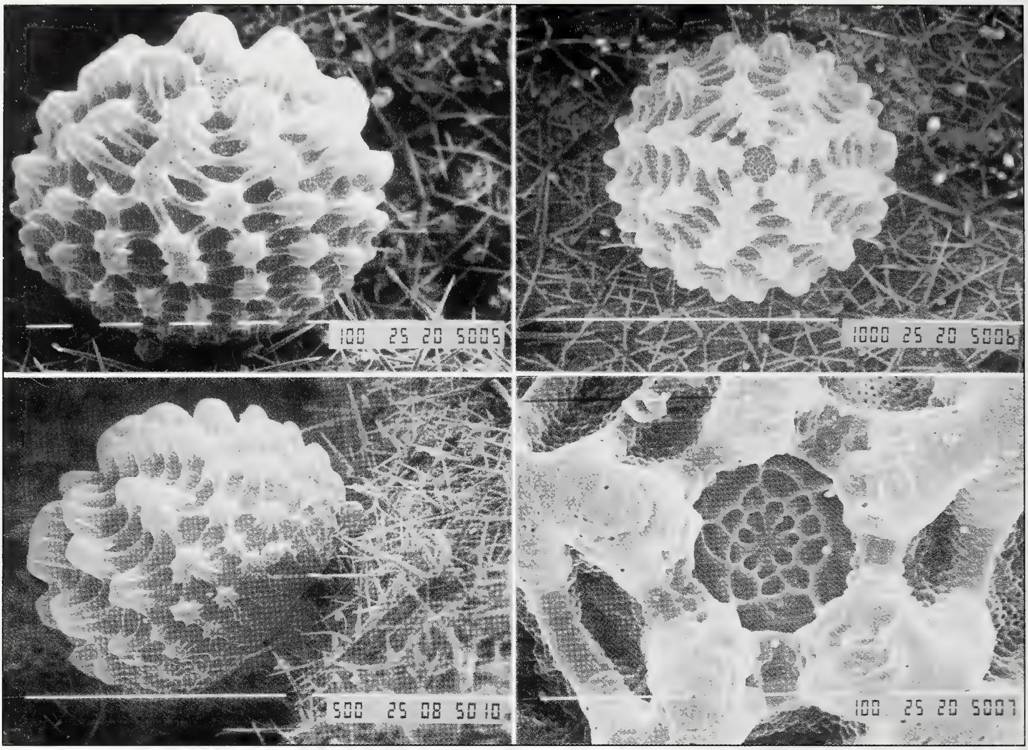


Fig. 2. *Carcharodus alceae* egg SEM (Scanning Electron Microscope) photographs (photo: Dr. Leonid Shikmanter).

Pupa. Pupation takes place inside the leaf pod (Fig. 6), the pupa being attached by means of the cremaster, sometimes with an additional thoracic girdle. It is up to 16 mm long, 5 mm in diameter, brown, and covered with white powder. The eyes and the spiracles are black. In August it hatches after 8–10 days (Fig. 7). On 21 February 1992, at the end of an exceptionally cold and wet winter, an overwintering L4 larva, 18 mm long, was found inside a leaf pod of *Alcea setosa* in Bet Arye, 310 m. It pupated on 15 March 1992, with the adult hatching a month later on 14 April 1992. On one occasion a winter-diapausing larva, which was found in Dvira, Northern Negev on 7 February 1981 inside an *A. setosa* leaf pod, emerged in July having spent some four months aestivating in the pupal stage.

Diapause. I noted three variations of diapause:

1) The autumn larvae of the final summer brood enter winter diapause which lasts until February in southern warmer localities, and until April in the central Mediterranean plateau. This is the only form of diapause reported until now in numerous books and other publications.

2) A pupal summer aestivation, spanning March to July, was found only once in a Northern Negev population (details were given above).

3) Winter pupal diapause – Two fully-grown larvae were found on 19 September 2003 inside leaf pods on *Chrozophora tinctoria* near Kibutz Haogen, Hasharon district, on

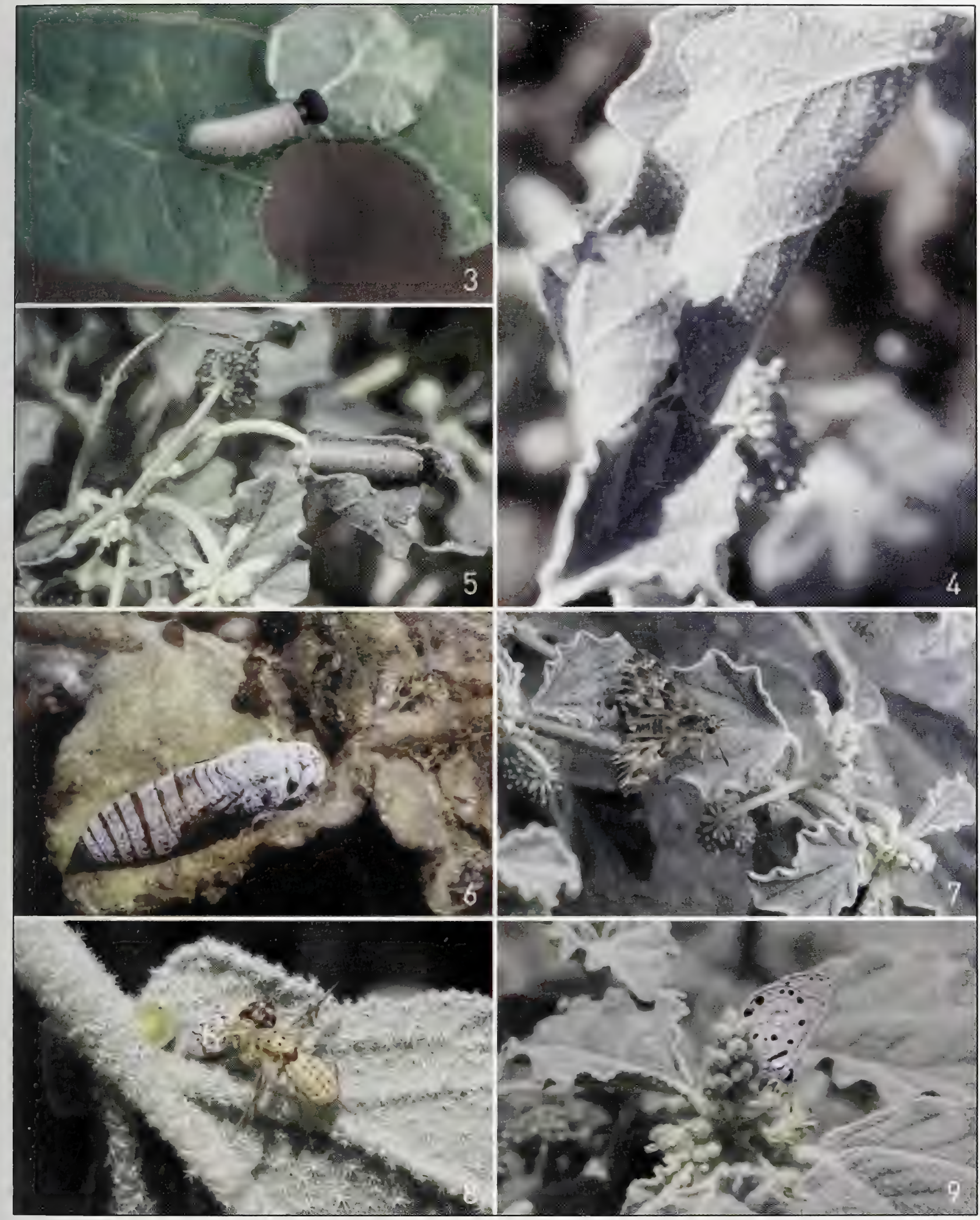
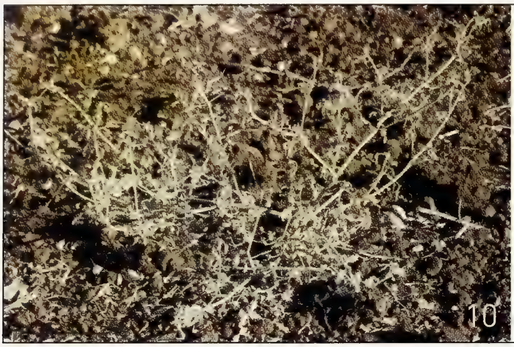


Fig. 3–9. 3. A young larva shown preparing its shelter on an *Alcea setosa* leaf. Santa Katarina Monastery, South Sinai, 1600 m, 22.vii.1979. **4.** *Carcharodus alceae* larval leaf pod on *Chrozophora tinctoria*. Same location and date as Fig. 1. **5.** Fully grown larva on *Chrozophora tinctoria*. Sasa, Upper Galilee, 880 m, 24.vii.2004. **6.** Winter diapausing *Carcharodus alceae* pupa. Kibutz Haogen, Hasharon district, Central Coastal Plain, Israel, 4.x.2003. **7.** Fresh *Carcharodus alceae* female from a larva which had developed on *Chrozophora tinctoria*. Sasa, Upper Galilee, 880 m, Israel, 4.viii.2004. **8.** Extrafloral nectaries of *Chrozophora tinctoria*. Attending beetles *Anthrenus* sp. (Dermestidae) and a fruit fly *Chaetorellia* sp. (Tephritidae) are possibly attracted to the nectaries. Rantis, Central Israel, ca. 200 m, 3.vii.2004. **9.** *Azanus jesous* nectaring on a flower of *Chrozophora tinctoria*. Hexagon Pool, Golan Heights, 50 m, 31.vii.2004 (Photos 8, 9: Eran Benyamini).



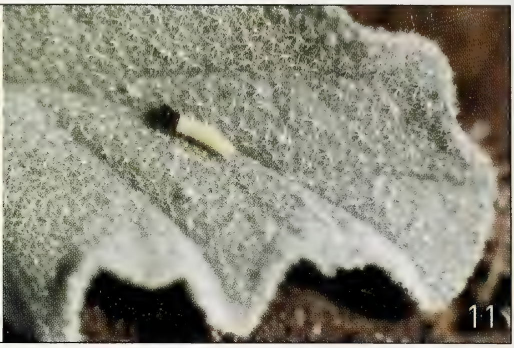


Fig. 10. Defoliated *Chrozophora tinctoria*. Rantis, Central Israel, ca. 200 m, 20.x.2004.
Fig. 11. 3 mm long L2 larva of *Carcharodus alceae* wandering over the stellate hairs of *Chrozophora tinctoria* leaf after being transferred from the original host-plant, *Alcea setosa*. Bet Arye, 310 m, 7.viii.2004.

the Mediterranean coastal plain in Central Israel. Both pupated on 2 October 2003. The pupae did not hatch and entered winter diapause (Fig. 6). On 29 February 2004 they were moistened with a few raindrops, but failed to hatch and later died. The precise timing of their demise is uncertain, as there were no external clues pointing to their change of condition. However, based on this very limited experience, it would appear that the late summer brood is potentially doomed; the adult‘s flight season is over, forcing the pupae to stay within the folded leaf. But the annual *C. tinctoria* dries up and loses all its leaves with the doomed pupae inside (Fig. 10).

This was my only experience with overwintering pupae of this species. However, in December 2004 Mr Evyatar Feingold, a young member of the Israeli Lepidopterist’s Society informed me that he found a larva of *Carcharodus alceae* on *Malvella* sp. in early November 2004 in Sde-Boker, Central Negev, elev. 465 m. This larva pupated on 14 November 2004 to become the second observation of a winter-diapausing pupa. It remains to be seen if this produces a viable adult.

Attending ants. At various locations small black ants were observed on host-plants. As the larvae were inaccessible inside their leaf pod, another reason had to be found to explain the ants‘ presence. (It was apparent that the ants were not attracted to the frass of the larvae). After close observation, the reason for their presence was revealed: tiny flat “buttons” on the undersides of leaves were found to be extrafloral nectaries (Fig. 8). On 31 July 2004 a large bush of *Chrozophora tinctoria* near the Hexagons Pool, on the Golan Heights, 50 m above sea level, was observed over a period of time. The flowers attracted adults of *Colotis fausta, Azanus jesous* (Fig. 9), *Tarucus balkanicus*, and one female of *Carcharodus alceae*. Numerous, small black ants were attending these special nectaries. The ants were identified by Armin Ionescu (Tel Aviv University) as *Crematogaster jehovae* Forel. It is quite reasonable to assume that their massive presence on the host-plant provided some protection to the larvae by discouraging potential parasitic wasps. However, in tropical forests where plants with extrafloral nectaries are very common (up to 53% in certain parts of Brazilian Amazon), the presence of numerous ants is a great threat to non myrmecophilous larvae

(Oliveira & Freitas, 2004). In the case of *C. alceae* larvae feeding on *C. tinctoria*, I did not find any evidence for such a threat in Israel.

Parasites and competing moths. Among ca. 20 larvae that were reared on *Chrozophora tinctoria* since 1988 none were attacked by parasites, thus demonstrating the effectiveness of their sealed leaf pod. Most of the leaf pods that were checked for *Carcharodus alceae* larvae were found to contain moth larvae. The microlepidopteran moths were identified by András Kun as Pyralidae of the family Phycitinae. The leaf pods of the moths are constructed as cylindrical webs that are not tightly sealed. In mid-June 2004 several leaf pods of *Chrozophora obliqua* were checked in Ein Gedi, Dead Sea valley (-370 m); all housed only moth larvae. One leaf pod was found to contain a white cocoon of a parasitoid wasp. *Apanteles glabratus* (Braconidae, Ichneumonidae) has been reported as parasitoid of young *C. alceae* larvae bred on *Alcea* sp. in Israel (Eisenstein 1983).

The host-plant

Chrozophora is a small genus in the large Euphorbiaceae family which contains 8100 species in 313 genera (Mabberley 2000). Twelve species are distributed from Portugal to Greece, Turkey, Cyprus, Africa and the Middle East to India and Thailand; two species grow in Southern Europe, and four in Israel: *C. tinctoria, C. obliqua* (Vahl) Ad. Juss. ex Spreng., *C. plicata* (Vahl) Ad. Juss. ex Spreng., and *C. oblongifolia* (Del.) Ad. Juss. ex Spreng. The latter two species are rare Sudanese plants growing in the Arava Valley and Southern Negev where *Carcharodus alceae* does not fly. However, *C. obliqua* has a distribution similar to that of *C. tinctoria* and therefore may be considered another possible host-plant.

C. tinctoria is distributed along the southern coast of Europe and was reported from Portugal, Spain, the Balearic Islands, France, Corsica, Sardinia, Italy, Sicily, ex Yugoslavia, and Greece to Turkey and Crimea (USSR) (Tutin et al. 1968). It is known from North-East Africa to west and central Asia (Loutfy 2000). In 'Flora of Turkey' it is reported from the East Aegean Islands of Lesvos, Khios, Leros, Kos and Rhodos to SW & Central Asia, and to Sokotra island in South Arabia (Davis 1982). Other sources indicate its existence also in Iraq and Iran. Its reported distribution overlaps completely with that of *Carcharodus alceae* (except lower Egypt where *C. alceae* does not fly). Thus *C. alceae wissmanni* may also feed on *C. tinctoria* in Yemen.

Chrozophora tinctoria is a summer-flowering annual bush, usually up to 50 cm high, growing from March to October, from sea level to 1650 m (Turkey). It grows in deep alluvial soils, in disturbed / waste places, sandy plains (Egypt), edges of cultivated surfaces, among summer crops, or in fallow fields where it may become a weed.

The external appearance of the plant is unique; its blade ovate-rhombic leaves are greyish-to-light-green (Fig. 1). This colour is the result of numerous stellate hirsute-to-woolly leaves, with minute white hairs covering their surface.

Its scientific name means the painter‘s *Chrozophora* and its properties have been known for thousands of years as a source of turn-sole dye (*Bezetta rubra*, tournesol). It was also used for colouring liqueurs, wine, pastries, linen, and Dutch cheeses (Mabberley 2000).

Other butterflies feeding on Euphorbiaceae and their distribution by zoogeographical regions

Hesperiidae. Euphorbiaceae are rarely used by skippers world wide; only 9 species of the world 3660 known species are recorded by Robinson et al. (2004); one of them (*Calpodes ethlius* in the New World) is possibly an error. Four species are listed in the Afrotropical Region: *Abanitis paradisea* on *Bridelia cathartica*, *Coeliades libeon* and *Gorgyra bibulus* on *Drypetes gerrardii*, and *Parosmodes moranti* on *Bridelia* sp. Two species in the Oriental Region: *Bibasis mahintha* on *Aporusa roxburghii* and *Hasora chromus* on the widespread Castor bean (*Ricinus communis*). One species in North America (Mexico) *Arteurotia tractipennis* on *Croton niveus*, which rarely penetrates south Texas. *Calpodes ethlius*, which was reported on *Phyllanthus* sp. for the New World, is almost certainly an error (de Jong, pers. comm.). One Neotropical species: *Dyscophellus porcius* on *Croton* sp. Braby (2000) added two species in Australia: *Chaetocneme beata* on *Croton insularis* and *Chaetocneme critomedia* on *Mallotus polyadenos* and *Macaranga* sp. None was recorded until now for the whole Palaearctic Region. The new total is therefore 11 species or 0.3% of all skippers worldwide.

Papilionidae. Only four species of four genera feeding on Euphorbiaceae are known from the Neotropical and Oriental-Australian Regions. Thus, 0.7% of the world‘s 572 known species of Papilionidae feed on Euphorbiaceae.

Pieridae. Fifteen species of four genera are given for the Oriental, Afrotropical, and Australian Regions. Only one (*Appias drusilla*) is known from the Nearctic and none is known yet from the Neotropical and Palaearctic Regions. This is 1.23% of the world‘s 1222 known species of Pieridae.

Nymphalidae. Euphorbiaceae feeders are most common in this family; no fewer than 150 species in 42 genera are known nowadays. This is 2.08% of the world‘s known 7222 species. The family is well represented in the tropics: 52 species in 11 genera in the Afrotropical Region, 47 in 17 in the Neotropics, 33 in 12 in Central America, 23 in 14 in the Oriental Region, but only 7 in 6 in the Nearctic, 3 in 3 in Australia, and one Palaearctic (the Japanese *Athyma perius*). There are no records of Euphorbiaceae being used by nymphalids in Europe and the Middle East, though *Vanessa cardui* (recorded on *Ricinus communis* in Hong Kong) and *Danaus chrys*ippus (recorded on *Euphorbia* in West Malaysia) are candidates.

Riodinidae. Few records exist for this family (only four species are recorded by Robinson et al. 2004), but thanks to the exceptional work by DeVries (1997) on the Costa Rican butterflies, we may summarize the situation there as follows: 255 species out of the world’s known 1402 Riodinids occur in Costa Rica. Of these 255, eight (3.14%) are recorded to feed on Euphorbiaceae. But since host-plants are known for only 85 species, the percentage of the Euphorbiaceae feeders may increases to 9.4% (of the known 85 species), which would be the highest in the world. The total world‘s known Euphorbiaceae feeders among Riodinidae are 12 species, making up 0.86%.

Lycaenidae. This extremely adaptable family stands second only to the Nymphalidae among world Euphorbiaceae feeders; 71 species in 37 genera are known Euphorbiaceae feeders, making up 1.37% of the known world‘s 5162 species. Most of them fly in the Old World tropics: 30 species in 20 genera in the Oriental Region, 16 in 8 in the Australian Region, 13 in 9 for Afrotropical blues, but only 8 in 6 in the Neotropical Region, 4 in 2 for the Nearctic, and 2 in 2 for the Palaearctic Region (*Megisba malaya* in Japan and *Chilades trochylus* in south-east Europe and the Middle East.).

Tables 1 and 2 present the known number of genera and species of butterfly feeding on Euphorbiaceae together with the number of genera and species of their host-plants by world regions.

The Palaearctic Region, Europe, and the Middle East. I was the first to report usage of a member of the Euphorbiaceae family as a host-plant by a butterfly in the Middle East: *Chilades trochylus* Freyer (= *Freyeria trochylus*) (Lycaenidae) eggs and larvae were found in Israel and the Sinai Peninsula on *Andrachne telephioides* L. (Benyamini 1984, 1990 & 2002). The present article adds a second European butterfly species to the very limited list of Euphorbiaceae feeders. In the whole Palaearctic Region there are only two other known Euphorbiaceae feeders; the widespread Oriental nymphalid *Athima perius* (L.) which ranges from India to Malaysia, South China (Hong Kong), Taiwan, and Japan, and *Megisba malaya* Horsfield (Lycaenidae), another Oriental species that reaches Japan. The genus *Megisba* Moore comprises only two species; the other is the Australian *M. strongyle*, which also feeds on Euphorbiaceae.

Among world regions the use of euphorbs as butterfly larval host-plants is lowest in the Palaearctic where just four species (0.21%) out of 1896 use Euphorbiaceae.

Neotropical Region. With 71 Euphorbiaceae feeders out of 7927 species, the percentage figure of 0.89% shows this to be the second lowest region. The ratio is highest in the nymphalids, where the larvae of no fewer than 47 species (1.64%) of the known 2857 are Euphorbiaceae feeders.

Oriental Region. 64 species of 4157 represent 1.54%. Use of euphorbs is most pronounced in the Pieridae where 7 out of 307 species account for 2.28%.

Nearctic Region. Despite having only 13 feeders, these represent 1.69% of the total known 767 species. The nymphalids are again evident, with 7 (3.27%) of 214 species.

Australian Region. 26 species out of 1226 represents 2.12%, which is second only to the Afrotropical Region (2.26%). The leading family is that of the lycaenids where 16 of 407 species make up 3.93%.

Afrotropical Region. This region holds the largest concentration of Euphorbiaceae feeders with 74 species representing 2.26% of the total 3267. The use of euphorbs is most pronounced in the nymphalids where they is used by 52 (4.49%) of the known 1156 species.

Central America. Costa Rica, where euphorbs are used by 7.62% of the nymphalids and 9.4% of the riodinids (where the host-plant is known), is a “hot spot” not only for butterfly biodiversity but also for Euphorbiaceae world feeders in these two families.

Feeding on milky/ toxic host-plants

The Euphorbiaceae family has been divided recently into five subfamilies (Webster 1994a, b): the Phyllanthoideae (no milky latex), the Oldfieldioideae (no milky latex),

Tab. 1. Distribution of World butterflies that feed on Euphorbiaceae; number of species per family per zone. Sources: Benyamini (1984, 1990), Braby (2000), Canals (2003), DeVries (1987, 1997), Heppner (1991), Robinson et al. (2004), and Scott (1986). * Costa Rican numbers are also included in the Neotropical totals. ** Unknown. *** Several species of butterflies fly in more than one zone. This row presents the real numbers of known Euphorbiaceae feeders.

	Papilionidae			**Pieridae**			**Nymphalidae**			**Riodinidae**			**Lycaenidae**			**Hesperiidae**			**Total per Region**		
	Euphorbiaceae Feeders	**Total Number of Species**	**Percentage (%)**	**Euphorbiaceae Feeders**	**Total Number of Species**	**Percentage (%)**	**Euphorbiaceae Feeders**	**Total Number of Species**	**Percentage (%)**	**Euphorbiaceae Feeders**	**Total Number of Species**	**Percentage (%)**	**Euphorbiaceae Feeders**	**Total Number of Species**	**Percentage (%)**	**Euphorbiaceae Feeders**	**Total Number of Species**	**Percentage (%)**	**Euphorbiaceae Feeders**	**Total Number of Species**	**Percentage (%)**
Palaearctic	0	84	0	0	167	0	1	1083	0,09	0	16	0	2	391	0,51	1	155	0,64	4	1896	0,21
Afrotropical	0	87	0	5	174	2,87	52	1156	4,49	0	11	0	13	1402	0,93	4	437	0,91	74	3267	2,26
Oriental	2	178	1.12	7	307	2,28	23	1563	1,47	0	20	0	30	1520	1,97	2	569	0,35	64	4157	1,54
Australia	0	70	0	5	187	2,67	3	349	0,86	0	22	0	16	407	3,93	2	191	1,05	26	1226	2,12
Nearctic	0	33	0	1	64	1,56	7	214	3,27	0	25	0	4	139	2,87	1	292	0,34	13	767	1,69
Costa Rica *	0	40	0	0	70	0	33	433	7,62	8	255	3,14	1	**		1	**		43	**	
Neotropical	2	120	1.67	1	323	0,31	47	2857	1,64	12	1308	0,92	8	1303	0,61	1	2016	0,05	71	7927	0,89
Total ***	4	572	0.7	15	1222	1,23	150	7222	2,08	12	1402	0,86	71	5162	1,37	11	3660	0,3	264	19240	1,37

Tab. 2. Quantities of known Euphorbiaceae host-plants for butterfly families in the world's major zoogeographical zones (Gen.=Genera ; Sp.=Species). Sources: Benyamini (1984, 1990), Braby (2000), Canals (2003), DeVries (1987, 1997), Robinson et al. (2004) & Scott (1986). * Several species of butterflies fly in more than one zone. This row presents real numbers.

	Papilionidae				**Pieridae**				**Nymphalidae**				**Riodinidae**				**Lycaenidae**				**Hesperiidae**			
	Butterflies		Hosts		Butterflies		Hosts		Butterflies		Hosts		Butterflies		Hosts		Butterflies		Hosts		Butterflies		Hosts	
	Gen.	Sp.	Gen.	Sp.	Gen.	Sp.	Gen.	Sp.	Gen.	Sp.	Gen.	Sp.	Gen.	Sp.	Gen.	Sp.	Gen.	Sp.	Gen.	Sp.	Gen.	Sp.	Gen.	Sp.
Palaearctic	0	0	0	0	0	0	0	0	1	1	2	4	0	0	0	0	2	2	3	4	1	1	1	1
Afrotropical	0	0	0	0	3	5	4	5	11	52	18	37	0	0	0	0	9	13	8	8	4	4	2	2
Oriental	2	2	2	2	3	7	5	10	14	23	20	35	0	0	0	0	20	30	11	20	2	2	2	2
Australia	0	0	0	0	2	5	3	7	3	3	3	3	0	0	0	0	8	16	7	14	1	2	2	2
Nearctic	0	0	0	0	1	1	1	1	6	7	6	10	0	0	0	0	2	4	1	2	1	1	1	1
C-America	0	0	0	0	0	0	0	0	12	33	7	20	6	8	5	5	1	1	1	1	1	1	1	2
Neotropical	2	2	2	2	1	1	1	1	17	47	14	38	4	5	2	2	6	8	1	2	1	1	1	1
Total *	4	4	4	4	4	15	7	22	42	150	36	118	7	12	6	6	37	71	24	46	11	12	9	11

the Acalyphoideae (latex absent), the Crotonoideae (latex reddish or yellowish-to-milky), and the Euphorbioideae (latex whitish, often caustic or poisonous).

Table 3 presents the number of butterfly species/feeders and their Euphorbiaceae host genera. The leading subfamily is the Acalyphoideae where 22 genera are used as host-plants by 141 species of butterfly. Phyllanthoideae are second with 13 genera and 81 butterflies, followed by Crotonoideae 6/ 52, Euphorbioideae 7/ 25 and Oldfieldioideae 1/ 2.

We calculated the number of genera used and their percentage in each subfamily. The results are presented in Tab. 4 with the total number of Euphorbiaceae feeders per subfamily.

Though toxicity of each plant genus within the subfamilies is not considered, the accumulated results of Tab. 4 suggest that butterfly preference among the Euphorbiaceae subfamilies declines as plants become more toxic. It also means that butterfly adaptation to toxic hosts, which may provide chemical defence, is slow, limited, and possibly problematic.

Rizk's (1987) phytochemical analysis of the Euphorbiaceae specifies the toxic compounds in this family; many of these host-plant genera appear in Tab. 3. It is important to note that Rizk's work presents chemicals that were found in specific plants; it does not mean that other plants including host-plants of the same genera have the same compounds. However, for the preliminary analysis in Tab. 5 I assume that each genus is homogeneous regarding chemical ingredients of its species.

Let us examine briefly the more common toxic compounds that were found in the Euphorbiaceae (Tab. 5):

Over 55 Terpenoids (tetra- and pentacyclic) have been identified; mostly in the latex of *Euphorbia* spp., but also in other parts (bark, leaves, flowers, stems, and roots). Such compounds were found also in the plant genera *Macaranga*, *Croton*, *Phyllanthus*, *Antidesma*, *Glochidion*, *Bridelia*, and *Sapium*.

Fatty acids have been reported from relatively few species. These include *Euphorbia* sp., *Trewia* sp. and *Hevea* sp.

Phenolic substances of the following types were identified: Flavonoids in several *Euphorbia* spp., Coumarins in *Mallotus* spp. and *Euphorbia* sp., Lignans in *Phyllanthus* sp., Tannins in *Mallotus* sp., *Euphorbia* sp., *Phyllanthus* sp., *Sapium* sp. and *Acalypha* sp., Quinones in *Acalypha* sp., *Euphorbia* sp., and *Hevea* sp., Phenolic acids in *Euphorbia* sp. and *Ricinus communis*.

Several types of Alkaloids exist especially in *Croton*, *Phyllanthus*, and *Securinega* species. Imidazole alkaloid was found only in *Glochidion* sp. Pyrimidine and Guanidine alkaloids were isolated only from *Alchornea* sp. Several Quinolizidine alkaloids were found in *Phyllanthus* and *Securinega* sp. Glycoalkaloids were found in *Euphorbia* sp.

Cyanogenic glucosides have been identified in Phyllanthoideae and Euphorbioideae. The taxa of these tribes can produce hydrocyanic acid. Several species of the following genera were found to be cyanogenic: *Andrachne, Bridelia, Euphorbia, Gymnanthes, Hevea, Manihot, Phyllanthus*, and *Securinega.*

Several *Euphorbia, Antidesma*, and *Croton* species are used as fish and arrow poisons. Extensive medicinal use of Euphorbiaceae plants has been known since antiquity. While many of these plants are extremely toxic, details of their use are beyond the scope of this article. However, the last column in Tab. 5 indicates which host-plant genus has medicinal importance.

Calculating the percentage of known toxic species in certain genera, and thus assuming which genus is toxic, yields interesting preliminary results for the use of toxic Euphorbiaceae genera as host-plants (Tab. 5). While 42.55% of the Acalyphoideae known host-plants are toxic (56.79% is given for the Phyllanthoideae), the figures for the subfamilies with toxic latex are much higher: 60% for Euphorbioideae and 92.31% for Crotonoideae. Further detailed research is needed to analyze these interesting results.

Lack of warning coloration

A straightforward comparison with other feeders of toxic plants, e.g. Papilionidae larvae on Aristolochiaceae and Danainae larvae on Asclepiadaceae, highlights other interesting differences: *Carcharodus alceae* and its larvae do not have warning coloration while it is highly pronounced in Papilionidae and Danainae.

Tab. 3. Usage of Euphorbiaceae subfamilies and genera by Rhopalocera. Sources: Tabs. 1–2, Mabberley (2000), Robinson (2004 and pers. comm.), DeVries (1997), G. L. Webster (1994a, 1994b, pers. comm.). * These figures include butterflies that feed on more than one Euphorbiaceae genus or tribe.

Euphorbiaceae subfamily	**Genus**	**Papilionidae**	**Pieridae**	**Nymphalidae**	**Riodinidae**	**Lycaenidae**	**Hesperiidae**	**Total**	**percent of world Euphorbiaceae feeders***
I. Phyllanthoideae	*Antidesma*			3		1		4	**26,91%**
No milky latex	*Drypetes*		12	3		3	2	20.	
	Phyllanthus		5	3		1		9	
	Securinega			3				3	
	Hyeronima			1	1			2	
	Bridelia		1	5		4	2	12	
	Aporusa						1	1	
	Uapaca			2		1		3	
	Baccaurea					3		3	
	Glochidion			6		9		15	
	Breynia		3	2		1		6	
	Andrachne					1		1	
	Flueggea			2				2	
Subtotal		0	21	30	1	24	5	**81**	
II. Oldfieldioideae	*Petalostigma*			1		1		2	**0,66%**
No milky latex									
Subtotal		0	0	1	0	1	0	**2**	

Tab. 3. Continued.

III. Acalyphoideae	*Clutia*					1		1	**46,84%**
Latex absent, leaves often petiolar or laminar glands	*Chrozophora*						1	1	
	Alchornea			7		2		9	
	Acalypha			8	1			9	
	Macaranga	1		8		7	1	17	
	Mallotus			4		5	1	10	
	Ricinus		2	8	3		1	14	
	Trewia					1		1	
	Dalechampia			38				38	
	Conceveiba			1	1			2	
	Erythrococca					1		1	
	Micrococca					1		1	
	Bernardia					1		1	
	Aparisthmium			2				2	
	Claoxylon			1				1	
	Cnesmone			1				1	
	Platygyna			1				1	
	Pterococcus			1				1	
	Tetracarpidium			2				2	
	Tragia			25				25	
	Adelia			1				1	
	Adriana					2		2	
Subtotal		1	2	108	5	21	4	**141**	
IV. Crotonoideae	*Hevea*		1	1		2		4	**17,28%**
Latex reddish or yellow to milky	*Manihot*			2				2	
	Codiaeum			1				1	
	Croton	1		30	4	4	3	42	
	Omphalea				2			2	
	Trigonostemon					1		1	
Subtotal		1	1	34	6	7	3	**52**	
V. Euphorbioideae	*Excoecaria*			3				3	**8,31%**
Latex whitish, often caustic or poisonous	*Sapium*			10				10	
	Euphorbia	1		2		1		4	
	Actinostemon	1						1	
	Gymnanthes			1				1	
	Maprounea			2				2	
	Sebastiana			4				4	
Subtotal		2	0	22	0	1	0	**25**	

Tab. 4. Euphorbiaceae subfamily preference by feeding butterfly species. [1] including butterflies that feed on more than one genus or subfamily.

Euphorbiaceae	No. of genera used as host-plants and their percentage within each subfamily	No. of species of feeding butterfly larvae [1]	Preference %
Phyllanthoideae	13 (22.4%)	81	26.91
Oldfieldioideae	1 (3.6%)	2	0.66
Acalyphoideae	22 (18.6%)	141	46.84
Crotonoideae	6 (9.8%)	52	17.28
Euphorbioideae	7 (16.6%)	25	8.31
Total	49 (15.9%)	301	100.00

The lack of warning coloration in *C. alceae* suggests that its acceptance of Euphorbiaceae is a very recent one. Most Rhopalocera larvae of Euphorbiaceae feeders appear to be cryptic, yet the recognized association of warning colours and toxicity in other species indicates that the Euphorbiaceae feeders will possibly develop warning coloration in the future. It has already happened in the conspicuous and possibly toxic larva of the hawkmoth *Hyles euphorbiae* (Sphingidae). It is our lucky privilege being able to follow this change in real time and to measure how many years it will take for these warning colours to develop. I expect it to be much shorter than we can guess or estimate nowadays. More than that, the change will possibly be pronounced only in the *Chrozophora* feeders while other *C. alceae* will not change. Does this also foretell a future speciation event in *C. alceae*?

Switching from Malvaceae to Euphorbiaceae - Summary

On 4 August 2004 in Bet Arye, Central Israel, elevation 310 m, foodplants were in short supply. Five first and second instar larvae and one un-hatched egg were found on a tiny *Alcea setosa* plant having only three leaves, each of 5 cm diameter. It is obvious that in such circumstances, with no other foodplant available, larvae will starve to death. This seasonally repeated shortage of host-plants in the dry Mediterranean summer, is the key driver for searching and switching to alternative plants. The five young larvae with their tiny leaves were transferred into separate breeding vials where fresh *Chrozophora tinctoria* plants were added. Three larvae accepted it quite willingly and were observed feeding on young leaves on 7 August. The other two wandered restlessly (Fig. 11), and eventually were seen accepting the *Chrozophora* reluctantly, and tentatively, on 11 August. Closer observation suggested that the hairs on the plant acted as mild discouragement to feeding. Finally, three adults hatched between 26 August and 2 September 2004. This experiment demonstrated that all the larvae switched from *Alcea* to *Chrozophora* but the final rate of success was three out of five, measured in terms of transition from larva to adult, which is 60%. The limited observation, if repeated under natural conditions, suggests that acceptance of this host- plant developed over the last sixteen years from 0% in 1988 to 60% in 2004. Field observations indicate that eggs which were laid directly on the *Chrozophora* developed normally, though some adults failed to emerge successfully. Switching to this summer host-plant appears to have the dubious benefit of extending the breeding season to the autumn, so that larvae feeding in late-season produce pupae which then find themselves in the cold, unfavourable climate of early winter and are forced to overwinter. We still do not know if they can survive the winter in this stage of their life cycle.

Are we witnessing a switching process (or an acceptance of an alternative host-plant) that has started in the recent past, and is still evolving? Lack of warning coloration in both larvae and adults support this hypothesis. Is it linked to the desiccation of our biotopes due to the greenhouse effect? We postulate that both processes are happening within the same timetable.

Tab. 5. Toxic chemicals of the Euphorbiaceae host-plants of butterflies.

Euphorbiaceae		**Terpenoids**	**Fatty acids**	**Phenolic substances**	**Alkaloids**	**Cyanogenic Glucosides**	**Medicinal plants**	**Total species feeders**	**% of toxic genera ***	**% of plant species which are toxic and used as host-plants****
I. Phyllanthoideae	*Antidesma*	v					v	4	**53,80**	**56,79**
No milky latex	*Drypetes*							20		
	Phyllanthus	v		v	v	v	v	9		
	Securinega				v	v		3		
	Hyeronima							2		
	Bridelia	v				v	v	12		
	Aporusa						v	1		
	Uapaca							3		
	Baccaurea							3		
	Glochidion	v			v		v	15		
	Breynia						v	6		
	Andrachne					v	v	1		
	Flueggea			v	v		v	2		
Subtotal								**81**		
II. Oldfieldioideae	*Petalostigma*							2	**0,00**	**0,00**
No milky latex										
Subtotal								**2**		

Tab. 5. Continued.

III. Acalyphoideae	*Clutia*						v	1	**27,27**	**42,55**
Latex absent, leaves often petiolar or laminar glands	*Chrozophora*						v	1		
	Alchornea				v		v	9		
	Acalypha			v		v	v	9		
	Macaranga	v					v	17		
	Mallotus			v			v	10		
	Ricinus			v	v		v	14		
	Trewia		v		v		v	1		
	Dalechampia							38		
	Conceveiba							2		
	Erythrococca						v	1		
	Micrococca							1		
	Bernardia							1		
	Aparisthmium							2		
	Claoxylon							1		
	Cnesmone							1		
	Platygyna							1		
	Pterococcus							1		
	Tetracarpidium							2		
	Tragia						v	25		
	Adelia							1		
	Adriana							2		
Subtotal								**141**		
IV. Crotonoideae	*Hevea*		v	v		v		4	**50,00**	**92,31**
Latex reddish or yellow to milky	*Manihot*			v		v	v	2		
	Codiaeum							1		
	Croton	v		v	v		v	42		
	Omphalea							2		
	Trigonostemon							1		
Subtotal								**52**		
V. Euphorbioideae	*Excoecaria*						v	3	**42,85**	**60,00**
Latex whitish, often caustic or poisonous	*Sapium*	v		v			v	10		
	Euphorbia	v	v	v	v	v	v	4		
	Actinostemon							1		
	Gymnanthes					v		1		
	Maprounea							2		
	Sebastiana						v	4		
Subtotal								**25**		

Finally, Mabberley (1997) in his discussion on similarities of the five Euphorbiaceae subfamilies noted: "The seed structure….of the others [incl. *Chrozophora*] show more affinity with…..Malvaceae…". Does it mean that this switching was inevitable?

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Acleris effractana (Hübner, 1799) – a Holarctic Tortricid

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Abstract. The discovery by Leraut (2003) of the existence of a species closely related to *Acleris emargana* (Fabricius, 1775) is confirmed. It is shown that this was already known to lepidopterists in the first half of the 19th century, but like many *Acleris* names later regarded as only a form, the name *Acleris effractana* (Hübner, 1799) is the oldest name for the species. A neotype for *A. effractana* is designated. *A. effractana* is shown to have a Holarctic distribution, with occurrence only in the northern part of Europe. *A. emargana blackmorei* Obraztsov, 1963 (**syn. n.**) and *Acleris stettinensis* Leraut, 2003 (**syn. n.**) are synonyms of *A. effractana* (Hübner). *A. effractana* is compared with *A. emargana* (Fabricius, 1775). Details of the variation in adults, biology and distribution of these two species are presented, and adults and genitalia are illustrated.

Zusammenfassung. Die Entdeckung der Existenz einer mit *Acleris emargana* (Fabricius, 1775) nahe verwandten Art durch Leraut (2003) wird bestätigt. Es wird nachgewiesen, dass diese Tatsache bereits Lepidopterologen der ersten Hälfte des 19. Jahrunderts bekannt war, wobei der Name *Acleris effractana* der älteste ist, aber wie viele andere *Acleris*-Namen später nur als Form behandelt wurde. Ein Neotypus für *A. effractana* wird hier designiert. *A. effractana* weist eine holarktische Verbreitung auf und ist in Europa auf die nördlichen Regionen beschränkt. *A. emargana blackmorei* Obraztsov 1963 (**syn. n.**) and *Acleris stettinensis* Leraut, 2003 (**syn. n.**) sind Synonyme von *A. effractana*. *A. effractana* wird mit *A. emargana* verglichen und die Variation, Biologie und Verbreitung beider Arten werden beschrieben sowie Imagines und Genitalien abgebildet.

Key words. Holarctic, variation, sibling species, *Salix*.

Introduction

Members of the genus *Acleris* Hübner, 1825 are among the most popular Microlepidoptera. The genus includes several beautiful species, and also some with extraordinary variability. During the 18th and 19th century many of the forms were thought to represent distinct species and were given names as such. Later on, especially during the first half of the 20th century, some authors, notably Sheldon (1930–31), tried to classify the forms of the variable species, proposing a large number of additional names for the forms. The nomenclature of many European *Acleris* species is thereby burdened by numerous synonyms and infrasubspecific names.

This variability also results in identification problems at the species level. One of the few European *Acleris* species which, in spite of remarkable variation, has always been considered easy to identify is *A. emargana* (Fabricius 1775) with its characteristic, and among European Tortricidae unique, emargination of the forewing costa. It was therefore surprising for us to see that Leraut (2003) described a new species of *Acleris* from northern Europe, allied to *A. emargana*. This author is well known for studying

old literature in order to ‘dig’ up the oldest name of any species (see e.g. Leraut 1997), but in this case he only discussed the old nomenclature briefly and proposed a new name, *A. stettinensis*, for the species discovered by him. This description was not published in a scientific journal, but in a ‘semi-popular’ book showing colour pictures of numerous insects.
We decided to test the validity of Leraut´s findings, and below we present the results.

Material and methods

A. stettinensis was described as a close relative of *A. emargana*, both in wing markings and in genitalia. We dissected a number of *A. emargana* of both sexes and compared them without first separating them on external characters. It turned out that, despite the differences being only small, these genitalia slides fall into two groups. Comparing the moths from which the genitalia were dissected also resulted in two groups: one with more or less similar, brownish grey specimens, and one with some rather variable specimens. The latter group fits *A. emargana* as currently understood, whereas the first group matches Leraut´s *A. stettinensis*. Based on the differences described below we are of the opinion that Leraut is correct and these two groups represent distinct species.
The type series of *Acleris emargana blackmorei* Obraztsov was borrowed from the USNM, and the genitalia of both sexes were compared with those of *A. stettinensis* and found to agree in every detail.

Abbreviations

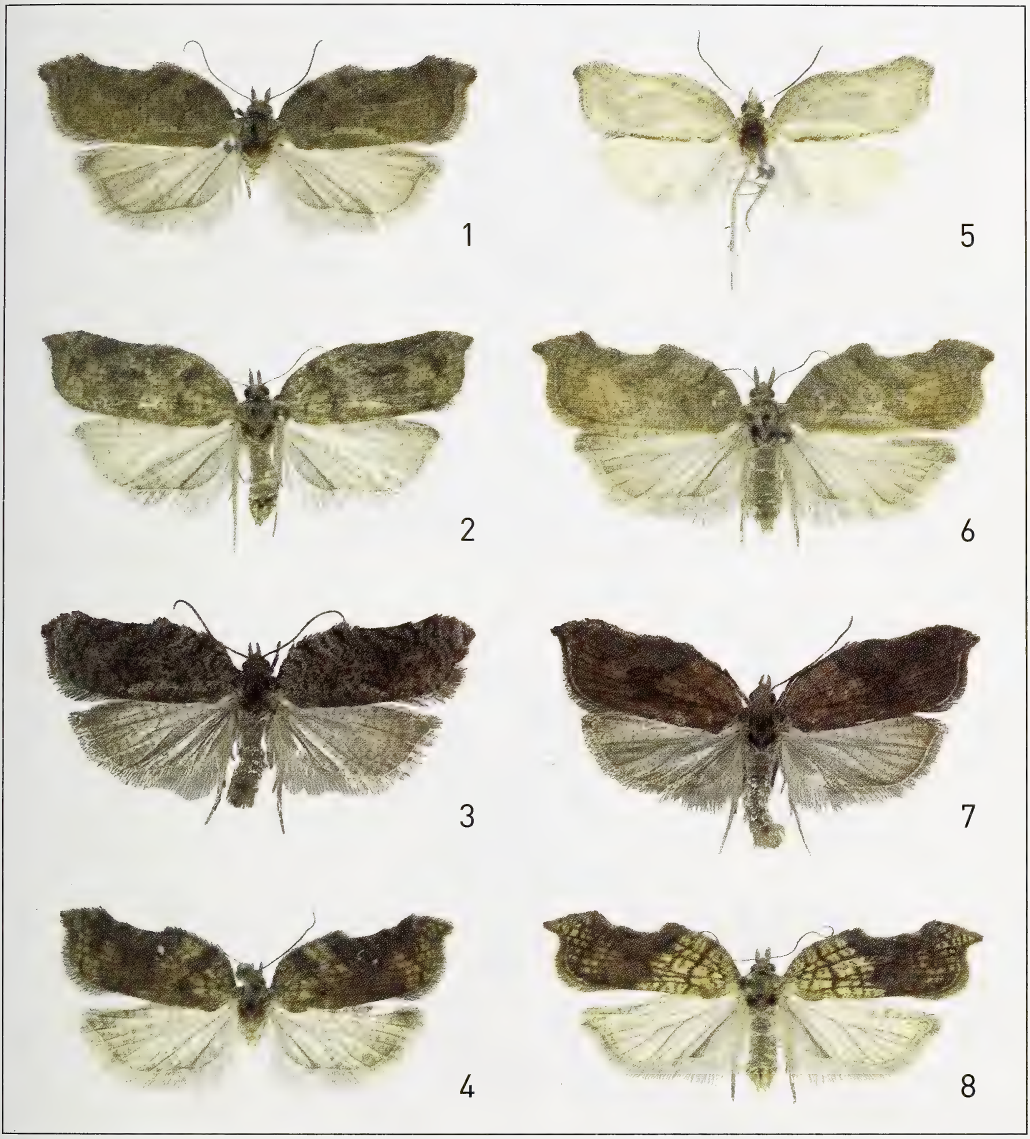
BMNH	The Natural History Museum, London, U. K.
HMUG	Hunterian Museum, University of Glasgow, Glasgow, U. K.
MTD	Staatliches Museum für Tierkunde, Dresden
MZHF	Zoological Museum, University of Helsinki, Finland
USNM	National Museum of Natural History, Washinton D. C., U.S.A.
ZMHB	Zoologisches Museum der Humboldt Universität, Berlin, Germany
ZMUC	Zoological Museum, University of Copenhagen, Denmark

RESULTS

Acleris effractana (Hübner, 1799) Figs. 1–4, 9, 11

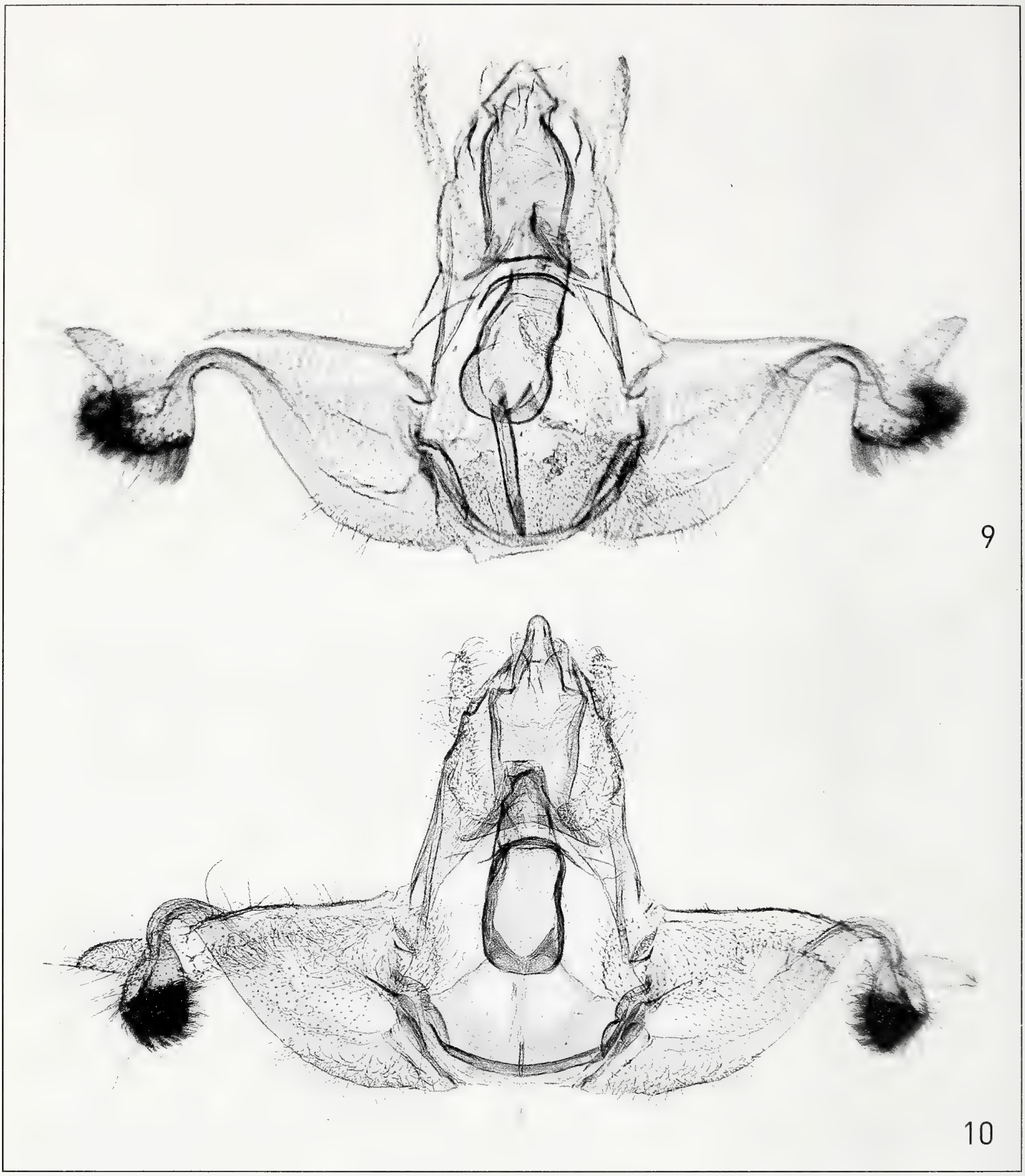
[*Tortrix*] *effractana* Hübner, 1799: pl. 28 fig. 175.
Rhacodia emargana f. *fuscana* Sheldon 1930: 148. Infrasubspecific name.
Acleris emargana blackmorei Obraztsov 1963: 268–269. **Syn. n.** (examined by DA & KT).
Acleris stettinensis Leraut 2003: 327, fig. 20; pp. 500–501, figs. 1, 3. **Syn. n.** (examined by OK).

Diagnosis (Figs. 1–4). Wingspan 21–23 mm. Forewing costa with emargination, ground colour brownish fuscous; pattern obsolete, costal triangle indicated as a darker shadow, and weak network pattern indicated by thin lines; groups of blackish erect scales form lines that emphasize the sub-basal fascia and inner edge of the median fascia. Hindwing light grey, more or less reticulate. The depth of the costal emargination varies, but is usually rather slight and not as deep as in most specimens of *A. emargana*. In some specimens the pre-tornal area appears weakly reddish.



Figs. 1–4. *Acleris effractana* (Hübner). **1–2.** ♀, Denmark (ZMUC, photos: Brovad). **3.** ♂, Great Britain (BMNH, photo: DA). **4.** ♀, Denmark (coll. K. Larsen, photo: Brovad).
Figs. 5–8. *A. emargana* (Fabricius). **5.** ♂, Denmark (ZMUC, photo: Brovad). **6.** ♀, Czech Republic (ZMUC, photo: Brovad). **7.** ♂, Great Britain (BMNH, photo: DA). **8.** ♀, Denmark (ZMUC, photo: Brovad).

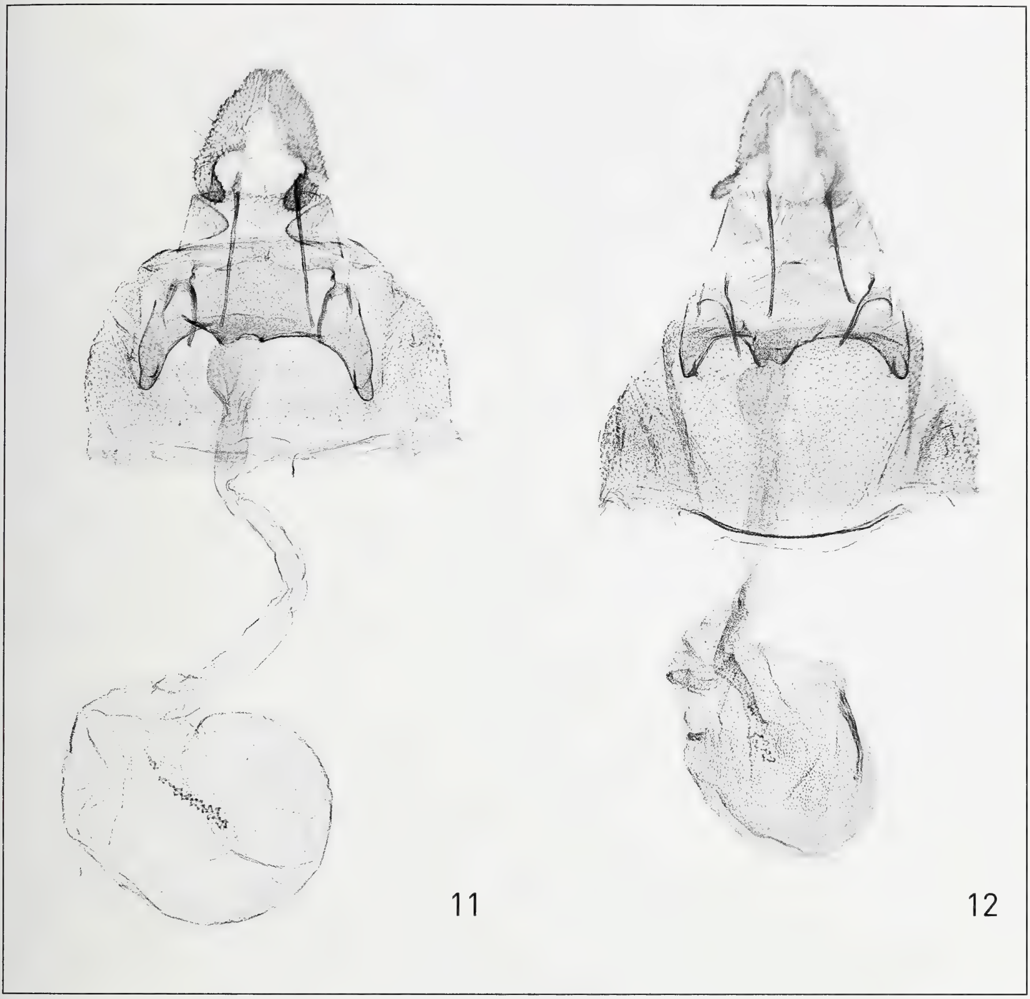
There is a form (Fig. 4) equivalent to the typical form of *A. emargana*, with ochreous ground colour and dark reticulate pattern. It differs from *A. emargana* by heavier dark suffusion, particularly the line forming the sub-basal fascia is thicker. It is apparently without a name. Dark, nearly unicolorous specimens with blackish groups of raised scales and weak emargination of costa certainly belong to *A. effractana*. One should, however, be aware that the raised scales are easily rubbed off, and are usually lacking in worn specimens. “Typical” *A. effractana* are figured by Bradley et al. (1973: fig. 11)



Figs. 9–10. Male genitalia (photos: PH, based on genitalia slides prepared by LA). **9.** *A. effractana* (Hübner). **10.** *A. emargana* (Fabricius).

under the infrasubspecific name *fuscana* Sheldon, by Buhl et al. (2004: fig. 3) and Leraut (2003: 327, fig. 20).

Male genitalia (Fig. 9). Socii slender, basally broader, reaching as far as tip of uncus, or even beyond this; uncus rather broad, nearly as a rounded triangle; sacculus of valva subterminally constricted; phallus short, straight, with small subterminal carina, no cornuti. The most reliable character versus *A. emargana* is the distinctly longer socii. The shape of uncus is variable in *A. emargana*, but is on the average narrower in



Figs. 11–12. Female genitalia (photos: PH, based on genitalia slides prepared by LA). **11.** *A. effractana* (Hübner). **12.** *A. emargana* (Fabricius).

A. emargana than in *A. effractana*. The carina of the phallus is smaller in *A. effractana* than in *A. emargana*, but this character is also variable to some extent.

Female genitalia (Fig. 11). Sterigma distally convex; the extensions of its anterior corners with small terminal process; ductus bursae membraneous, widening before ostium; signum weak, with small teeth, split in two or three parts. For differences from *A. emargana* see under that species. Leraut (2003: 501, fig. 3) in his description of *A. stettinensis* indicated differences between the two species in the size of the papillae analis, the shape of the anterior corners of the sterigma, and the shape of the posterior part of ductus bursae. However, study of numerous slides of the female genitalia of the two species has shown that these characters are variable. The only reliable specific character seems to be the difference in the relative length of the ductus bursae in the two species.

Life history. The larva is bluish green. It lives between leaves spun together in the terminal shoots of *Salix pentandra* (Buhl et al. 2004: 33, 41), in the British Isles it has been bred from tubed leaves of *Salix purpurea* and from spun leaves of *S. cinerea* and *S. purpurea*, larvae being found in June. Adults can be found (in Denmark) from the end of July to early October.

Distribution. Holarctic. Throughout North Europe and northern part of Central Europe: Single records from the west of Ireland and one old specimen from northern England (a single specimen from Surrey in southern England may be due to mislabelling); widespread in Scotland where it occurs with *A. emargana*, usually less common, but in the Hebrides and Northern Isles (Shetland and Orkney) it is the commoner species; in Denmark widely distributed, but more local than *A. emargana* (see Buhl et al. (2004: 40-41) for list of material); in Norway scattered all over the country, almost to North Cape; throughout Sweden (Svensson 2005: 32); nearly all of Finland, most common towards north (Kullberg et al. 2002); Estonia (U. Jürivete, in litt.); Latvia (N. Savenkov, pers. comm.); Germany (Braunschweig and Neustrelitz (Fischer von Röslerstamm 1839), Bautzen in Sachsen (coll. MTD)); Poland: Szczecin ['Stettin'] (Leraut 2003), (NW) Russia (Leraut 2003; Kullberg, in litt.), Japan (Yasuda 1965); Canada and north-western USA (Obraztsov 1963). The occurrence in Central Europe, especially in mountainous areas such as the Alps seems well possible but no specimens belonging to *A. effractana* could be examined so far.

Remarks. *Tortrix effractana* was figured and named by Hübner (1799: pl. 28 fig. 175) without accompanying description. The type locality is not stated, but Hübner´s figure was based on material received from Zincken (Fischer von Röslerstamm 1839: 141), and it is thus likely that it originated from the Braunschweig area in northern Germany where Zincken lived. Hübner´s figure 175 is difficult to interpret, as discussed by Frölich (1828: 27), and according to Fischer von Röslerstamm (1839) it is characterized by traits of both *Acleris* species discussed in this paper. However, Fischer von Röslerstamm was well aware of these two species, and he argued in details that Hübner´s *effractana* represents the grey brown species with two lines of small black scales in the middle of the forewing ("die ziemlich deutlichen (in der Natur aus schwarzen Schuppen-Puncten bestehenden) beiden Linien in Mittelraume").

As it is indeed possible that the figure is drawn from specimens of both we here, in order to stabilize nomenclature, designate a neotype [*Tortrix*] *effractana* Hübner. All the qualifying conditions of section 75.3 of the ICZN Code, 4th edition are met. We agree with Fischer von Röslerstamm´s opinion on the identity of *A. effractana*, and select as neotype a specimen of the species with two lines of small black scales in the middle of the forewing. It is a female in good condition, labelled: '9.8.[18]73' 'Stettin' 'ex collect. Staudinger' 'NEOTYPE Tortrix effractana Hübner, [1799] O. Karsholt design, 2005' (ZMHB). The locality Stettin [now Szczecin in Poland] was then a part of Germany.

The year of publication for *Tortrix effractana* (Hübner) was erroneously stated to be 1822 by Brown et al. (2005: 48).

A. blackmorei was described by Obraztsov as a subspecies of *A. emargana* from a series of specimens from western Canada (British Columbia and Ontario) and U.S.A.

(Washington State). He commented that the species name "had been adopted from labels on genitalia slides prepared by Busck who considered *A. blackmorei* to be a separate species". Obraztsov preferred to publish the taxon at subspecific rank as he believed, erroneously, that there were no genitalic differences between it and *A. emargana*.

Rhacodia emargana f. *fuscana* was described from an unstated number of specimens from Ireland (Sheldon 1930: 148). Infrasubspecific name.

A. stettinensis was described from 11 males and 7 females from Germany, Great Britain, Poland and Russia, all of them old specimens with insufficient label data. The holotype originated from Szczecin ['Stettin'] in Poland. None of the Russian specimens have exact locality data. The type series is exclusively of the rather unicolorous brown form.

Leraut (2003: 500) compared his *A. stettinensis* with *A. emargana, A. emargana tibetica* and *A. blackmorei*, stating that also the latter differs in the genitalia, but without stating the differences.

The figures of an adult and of female genitalia shown for *A. emargana* from Japan (Yasuda 1965: figs. 50, 79) most likely belong to *A. effractana*.

The form with ochreous ground colour and dark reticulate pattern is much rarer than the equivalent, typical form of *A. emargana*; we have only seen few specimens of this form from Denmark and Norway.

Acleris emargana (Fabricius, 1775) Figs. 5–8, 10, 12

Pyralis emargana Fabricius 1775: 651 (examined by DA & KT).
Pyralis caudana Fabricius 1775: 651 (examined by DA & KT).
Tortrix excavana Haworth 1811: 408 (examined by DA & KT).
Teras caudana var. *ochracea* Stephens 1834: 168.
Acalla emargana f. *fasciana* Müller-Rutz 1927: 505-506. Infrasubspecific name.
Rhacodia emargana f. *griseana* Sheldon 1930: 124. Infrasubspecific name.
Acalla var. *caudana* f. *brunneastriana* Weber 1945: 356. Infrasubspecific name.
Acleris emargana tibetica Razowski 1964: 412–414, fig. 93 (examined by DA & KT).

Diagnosis (Figs. 5–8). Wingspan 19–23 mm. Forewing costa with emargination that varies much in depth. Ground colour yellow-ochreous with reticulate pattern; median fascia sharply defined inwardly, becoming more diffuse distally, confluent with indistinct preapical spot. Hindwing greyish white, almost translucent, with slight reticulation, particularly in terminal half. This diagnosis applies to the typical form. The most common form (Fig. 6) has indistinct markings, ground colour ochreous, and grey suffusion except in tornal part. This form can easily be confused with *A. effractana*. It has groups of erect scales in the basal half of the wing, but these appear whitish, not black as the ones in *A. effractana*. The emargination of the forewing costa is generally deeper than in *A. effractana*. According to Bradley et al. (1973: 219) the name *caudana* should be restricted to a rare form with a reddish or orange streak along dorsum, whereas the common form should be called f. *griseana* Sheldon.

Male genitalia (Fig. 10). As in *A. effractana*, but socii not reaching as far as tip of uncus; uncus narrower than in *A. effractana*; subterminal carina of phallus larger than in *A. effractana*.

Female genitalia (Fig. 12). As in *A. effractana*, but ducus bursae shorter. The only reliable difference between *A. effractana* and *A. emargana* seems to be in the length of the ductus bursae. The ratio between the width of the sterigma and the length of ductus bursa is from 0.71 to 1.03 (in average 0.84; n=11) in *A. emargana*, and from 0.48 to 0.64 (in average 0.56; n=8) in *A. effractana*.

Life history. The larva is, when young, whitish green, later light green with almost similar coloured pinacula and a darker dorsal line. The head is honey-coloured with some black dots; thoracic plate and legs are light green. It feeds in late May and in June in folded leaves, or between two leaves, of especially *Salix caprea*, occasionally also on *Betula* and in Norway also on *Populus tremula*. It pupates in the second half of June between the leaves or among moss. The pupa is light brown, its proximal end is broad, horn-shaped, with two strong, curved thorns (Fischer von Röslerstamm 1839: 142, pl. 54). According to Bradley et al. (1973: 219) it also feeds on *Betula*, *Corylus* and *Alnus*. Adults can be found from July to September.

Distribution. North, Central and eastern Europe; recently recorded from Spain (Huesca) (Beltrán 2005); According to Razowski (1984: 200) throughout Siberia to China, Korea and Japan. These records probably refer to both *A. emargana* and *A. effractana*. In MZHF are specimens of *A. emargana* from Siberia (Altai and Buryatia) and from North China (Heilongjiang) (J. Kullberg in litt.). In Tibet subspecies *tibetica* Razowski, 1984.

Remarks. *Pyralis emargana* was described from an unspecified number of specimens from England, probably collected by Lee (Fabricius 1775: 651). The collection of J. Lee (or part of it) was stated to be in the University Museum of Oxford (Smith 1986: 133). DA sought there in vain for the types of *P. emargana* and *P. caudana*, and was informed that they may be in the HMUG, which turned out to be the case. We consider the single specimen there, which belong to the nominal form of *Acleris emargana*, to be the holotype of *P. emargana* Fabricius.

Pyralis caudana was described from an unspecified number of specimens from England. Fabricius (1775: 651) gives no origin of his specimens, but they may well have originated from Lee too. There are two specimens of the form with indistinct markings and ochreous-grey ground colour in the HMUG, and we consider these to be syntypes of *P. caudana* Fabricius.

Tortrix excavana was described from an unstated number of specimens from Great Britain. The name has in the past been attributed to Donovan (1794: 92). However, he did not describe *excavana*, but rather used it as an 'in litteris name', mentioning that it was "known among collectors" under that name. The name *excavana* represents specimens with ground colour varying from light to dark ferruginous-brown without the heavy strigulation or reticulation basally (Bradley et al. 1973: 219, pl. 46 figs. 9–10).

Teras caudana var. *ochracea* was described from an unstated number of specimens from England. It was stated to be of "a pale ochreous colour" (Stephens 1834: 168). As already pointed out by Sheldon (1930: 123) none of the specimens in the BMNH coming from the Stephens collection exactly matches that diagnosis, but are pale specimens of typical *emargana*.

Acalla emargana f. *fasciana* was described from two specimens from Switzerland (Schuls and Altberg an der Lägern) (Müller-Rutz 1927: 505–506). According to the description it is similar to the form figured by Bradley et al. (1973, pl. 46 fig. 10). Infrasubsepcific name.

Rhacodia emargana f. *griseana* was described from an unspecified number of specimens ("most frequently") from Great Britain (Sheldon 1930: 124). Infrasubspecific name.

Acalla var. *caudana* f. *brunneastriana* was described from an unspecified number of specimens from Switzerland. It represents the form with greyish brown forewings with the dorsal part of the forewing red-brown. From the description *brunneastriana* is clearly an infrasubspecific name.

Acleris emargana tibetica was described from 11 specimens collected in Gyangste, Tibet, at an altitude of 3900 m (Razowski 1964: 412–413). We follow here Razowski (1984: 201) in regarding *tibetica* as a subspecies of *A. emargana*.

Pyralis scabrana Fabricius, 1781 has been listed as a further synonym of *A. emargana* by, e.g., Razowski (1984: 198). The type, which is kept in the HMUG was studied by DA and KT. It is a synonym of *Acleris kochiana* (Goeze, 1783) (syn. rev.), but it is also a secondary homonym of *Acleris scabrana* ([Denis & Schiffermüller], 1775) and thus invalid.

It is no surprise that the two main forms of the dimorphic *A. emargana*, the bi-coloured nominate form and the rather plain grey form (f. *caudana*), originally were considered different species and described accordingly. The first to show that these two only represent forms of the same species was Fischer von Röslerstamm (1839: 141–142), who repeatedly bred both forms from larvae which were indistinguishable. From his bred material, originating from Bohemia, about 6% were the nominate form, the large majority belonging to f. *caudana*. In the collection of ZMUC there are 343 specimens of *A. emargana*. About 40% of these belong to the nominate form, but this may well be an artefact caused by collectors wish to collect more specimens of the rarer and more beautiful nominate form.

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The larval host plant of *Polyommatus eroides* (Frivaldszky, 1835) (Lycaenidae) from Poland with comments on the life history

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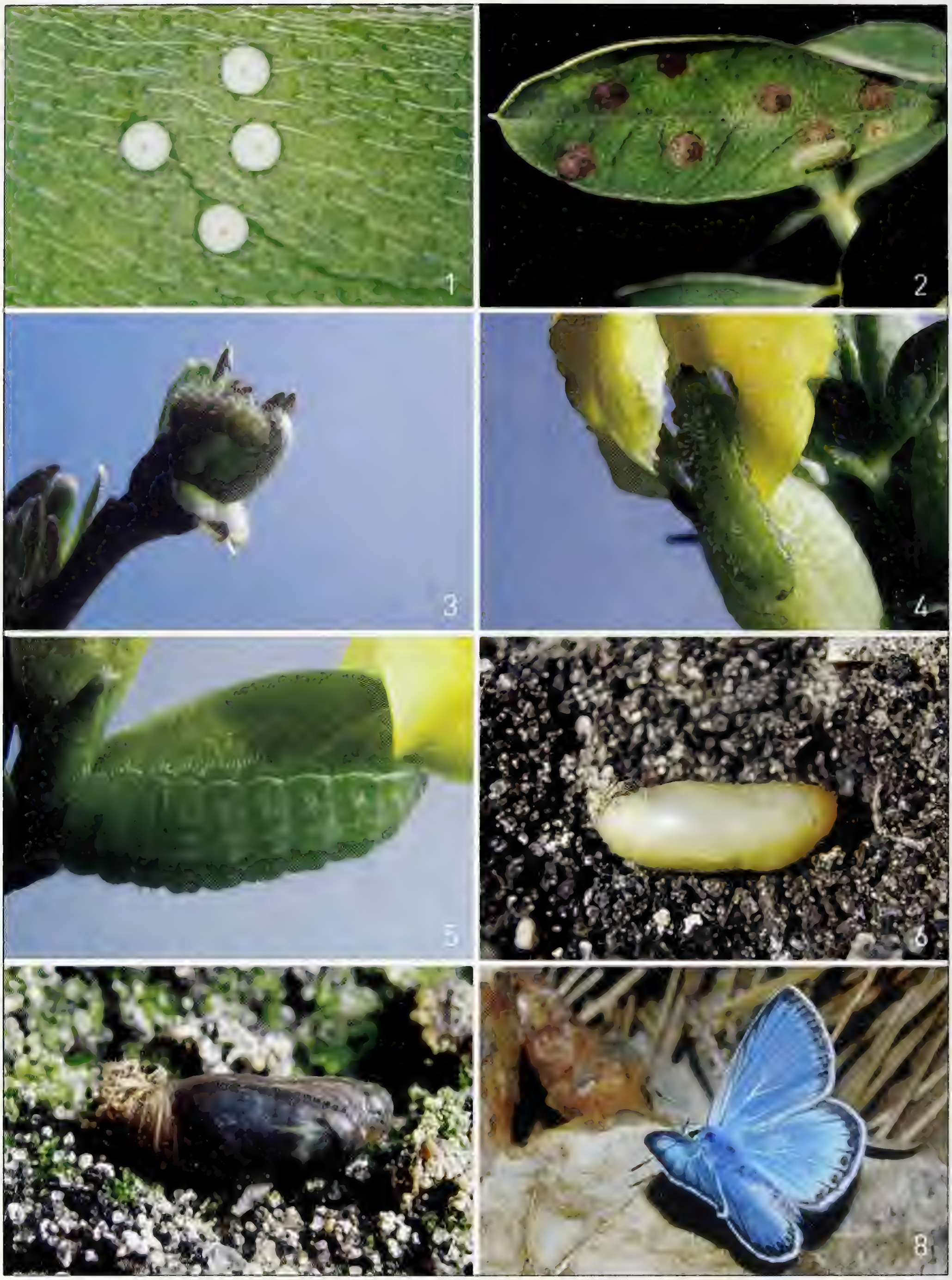
Abstract. *Polyommatus eroides* (Frivaldszky, 1835) (Lycaenidae) is an endangered species of little known life history. It is distributed mainly in south-eastern Europe and reaches west Siberia. *Oxytropis* sp. and *Astragalus* sp. (van Swaay & Warren 1999) and *Genista depressa* (Tolman 1997) were mentioned as larval hostplants. Tolman (1997) recorded little data on the life history (including the way larvae feed and larval attendance by *Tapinoma* sp. ants). *Chamaecytisus ruthenicus* (Fabaceae) is shown here to be a larval hostplant of *P. eroides* in young pine woods to the east of the Puszcza Knyszyńska Forest in north-eastern Poland. The life cycle was observed in the laboratory from a fertilised female captured at the locality of Narejki (UTM: FD98) and five adults reared. In the summer L1, L2 and L3 larvae fed on leaves, leaving round almost transparent traces on the cuticles. Third instar larvae hibernated. In the spring larvae fed on buds, developing leaves, flower buds, and then flowers. *C. ruthenicus* was also confirmed to be a larval hostplant in nature – eggs, early instar larvae and traces of feeding on leaves were found at the locality of Grzybowce (UTM: FD88). Interactions of larvae with ants were not recorded, but *Formica cinerea*, *Myrmica ruginodis* and *Tetramorium caespitum* were identified on flowering plants.

Key words. Lycaenidae, *Polyommatus eroides*, larval hostplant, *Chamaecytisus ruthenicus*, life history, Poland.

Introduction

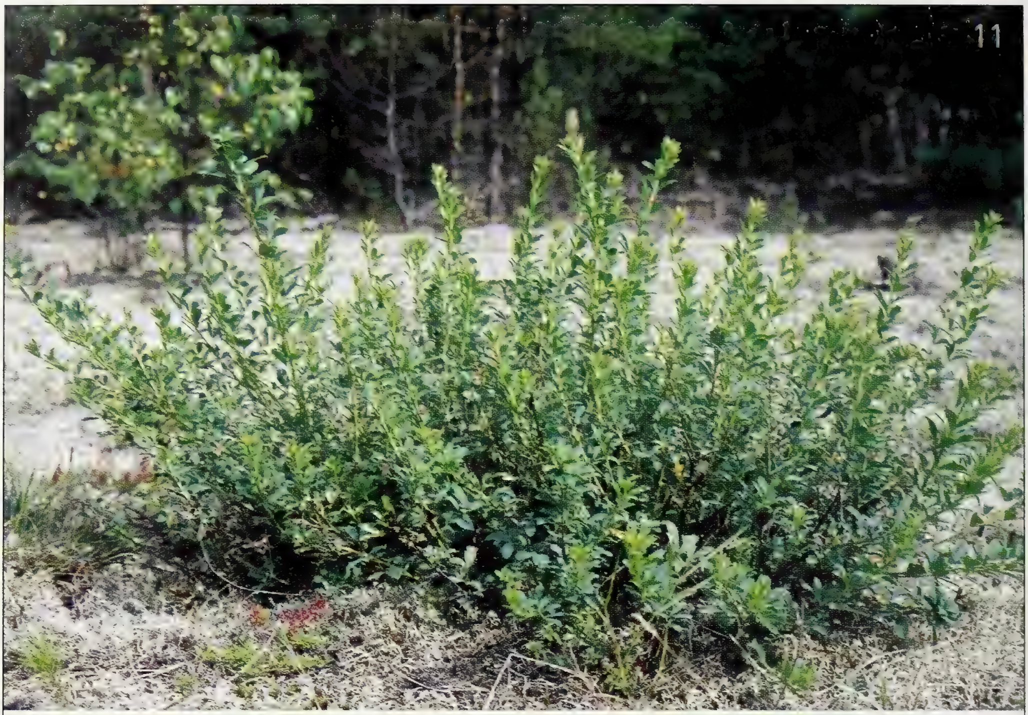
The False Eros Blue (*Polyommatus eroides* Frivaldszky, 1835) (Lycaenidae) is a species of little known life history. Additionally, it is critically endangered in Europe, where the distribution has decreased by 50–80% between 1970–1995, and its populations are often small, fragmented and isolated (van Swaay & Warren 1999). In Poland it has been classified as endangered (Buszko & Nowacki 2002) and has been protected since 2001. It is distributed mainly in south-eastern Europe (Bulgaria, Greece, Albania, Republic of Macedonia, Yugoslavia), but also in Poland, Slovakia, Ukraine, Belarus, Russia, and Turkey, while in the east it reaches west Siberia (van Swaay & Warren 1999). It was observed at one locality in the Czech Republic – in the years 1950–1957 where later on it became extinct (Beneš et al. 2002). According to the region of occurrence, it inhabits dry calcareous and siliceous grasslands and steppes, alpine and subalpine grasslands, rocky or sandy places, edges of forests, young pine woodlands, wet forest meadows and small open places in forests with fresh soil between 1000 and 2000 m (van Swaay & Warren 1999; van Swaay pers. comm.). In most countries, there is no larval hostplant recorded. Van Swaay & Warren (1999) mentioned *Oxytropis* sp. and *Astragalus* sp. (Fabaceae) as *P. eroides* larval foodplants. This information was recorded from dry calcareous grasslands and steppes and dry siliceous grassland in Slovakia (van Swaay pers. comm.). Tolman (1997) mentioned another hostplant – *Genista depressa*. Moreover, he stated that eggs are laid on leaves, small larvae feed on leaves, hibernating larvae feed on flowers, and caterpillars are attended by *Tapinoma* sp. ants (Formicidae).

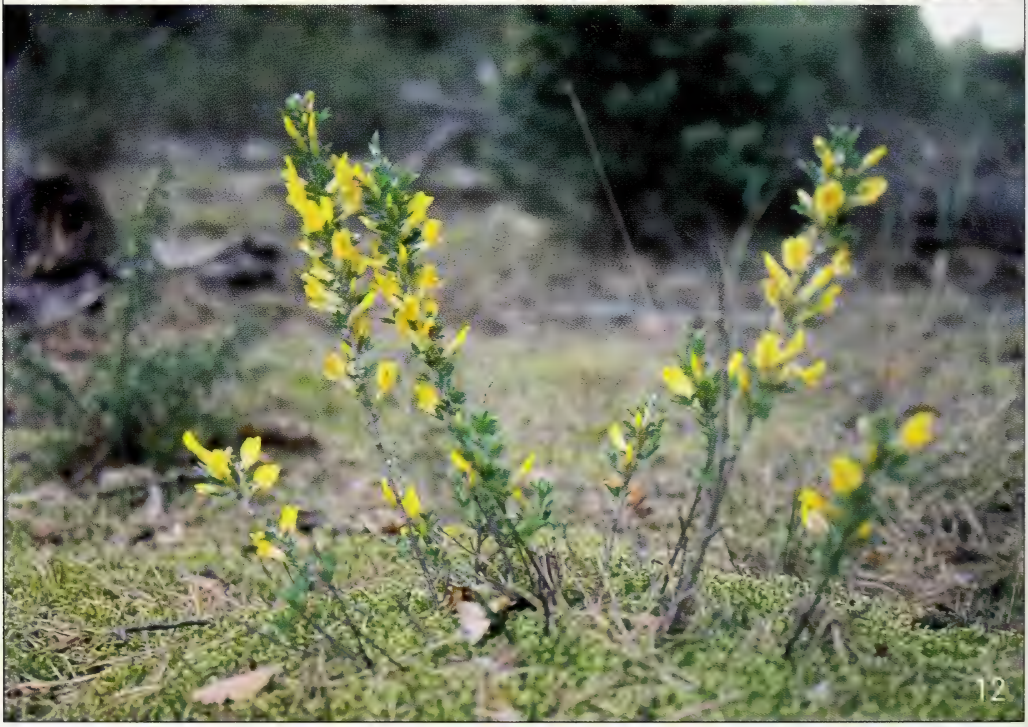


Figs. 1–8. Stages of development of *P. eroides*. **1.** The eggs (photo by J. Chobotow). **2.** 2nd instar larva feeding on leaves in August. **3.** 3rd instar larva feeding on buds in April. **4.** 4th instar larva feeding on flowers in May. **5.** The final instar larva on flowers in May. **6.** Four-days old pupa. **7.** Pupa before a male emergence. **8.** The male.

Figs. 9–10. The habitats of *P. eroides*. **9.** The locality of Narejki. **10.** The locality of Grzybowce.

Polyommatus eroides eroides (Frivaldszky, 1835) is the subspecies that occurs in Poland (Carbonell 1994). According to older data, it was very rare at several localities in the northern, central, and southern parts of the country (Romaniszyn 1929). In the Puszcza Białowieska Forest it was common in its eastern part (nowadays in Belarus) and rarer towards the west (Krzywicki 1967). Glades and edges of dry pine and coniferous forests were identified as a typical habitat for *P. eroides* (Krzywicki 1967). According to more recent data, *P. eroides* is found in Podlasie in north-eastern Poland (Buszko 2000; Buszko 1997; Klimczuk & Twerd 2000). It was also recorded in the southern part of the Puszcza Białowieska Forest and in areas to the south-east of it, towards the river Bug (Buszko 1997). Larval hostplants were not known. In 1998 *P. eroides* was found





Figs. 11–12. The larval hostplant of *P. eroides*. **11.** *Chamaecytisus ruthenicus* at the locality of Grzybowce in August. **12.** *Chamaecytisus ruthenicus* at the locality of Grzybowce in May.

north of the Puszcza Białowieska Forest, in the eastern part of the Puszcza Knyszyńska Forest (Klimczuk & Twerd 2000). Further observations carried out in this area resulted in obtaining more information on the life history of that species.

Material and methods

The study was divided into two parts. The first was initiated during routine observations of butterflies near the village of Narejki (UTM: FD98), to the east of the Puszcza Knyszyńska Forest. In the clearing of a dry pine forest I observed a flying male and a female of *P. eroides* (17.vii.1999) (Fig. 9). The female, when captured and placed in a small dark box, laid 10 eggs on the leaves of *Chamaecytisus ruthenicus*. This plant was selected based on an analysis of the floristic composition of the clearing and on a short observation of the female before it was captured. The caterpillars were reared on cut stems of the plant. The container with the larvae was exposed to natural temperatures (in winter the temperature decreased below 0 °C). The larvae survived the hibernation period on fallen leaves of the plant, kept in a container with humid soil. From the upper side and the soil side the hibernated larvae were covered with lignin for protection. Due to the small quantity of available material the rearing was focused on obtaining adults. The second part of the project involved field observations with the purpose of confirming the conclusions drawn from the laboratory results. The observations were carried out near the village of Grzybowce (UTM: FD88) in a long and narrow clearing in a dry, young pine forest (Fig. 10). *P. eroides* was first reported there in 1998 (Klimczuk & Twerd 2000); two males were found there as well on 03.vii.1999 (author's observation). The dwarf shrubs of *C. ruthenicus* (Figs. 11, 12) growing along a 2 km stretch were examined. Ova and larvae were collected in the field and reared in the same way as during the first stage of the research. Ants (5–10 workers of each species) were collected from flowering plants for identification.

Photographs of the localities, larval foodplant, and developmental stages of *P. eroides* were made.

Results

First part of the study. The life cycle of *Polyommatus eroides* was observed in the laboratory from the moment of oviposition by the captured female till the emergence of the imagines. From ten eggs five adults (3♂ and 2♀) were reared. The chronology of the rearing is presented in Table 1. In the summer, younger larvae (L1, L2 and L3) fed on upper and lower sides of leaves, leaving circular and almost transparent traces on the cuticle, but did not gnaw right through the leaves (Fig. 2). The third instar larvae (and one fourth instar larva) hibernated. The additional summer moult observed for one caterpillar was probably caused by an injury to this larva during its transfer to a fresh part of the plant. After an hibernation period lasting over seven months (from the first decade of September to the first half of April), two moults took place. In the early spring (April), after regaining activity, larvae fed on buds (Fig. 3), then on developing

Tab. 1. Rearing data – chronology. These events are presented only for trials resulting in the emergence of the adults.

Developmental stage	**Rearing initiated from a female captured (first part of research)**	**Rearing initiated from an ovum found in the field (second part of research)**
	oviposition: 17.vii.1999	ovum found: 13.viii.2000
ovum stage	17.–24.vii.1999 (7 days)	?–14.viii.2000
larva stage	24.vii.1999–16./19.v.2000 (> 9.5 months)	14.viii.2000–28.v.2001 (9.5 months)
first instar	24.vii.–30./31.vii.1999 (6–7 days)	14.–21.viii.2000 (7 days)
second instar second instar (only one larva) third instar (only one larva)	30.–31.vii.–24./29.viii.1999 (25–29 days) 31.vii.–18.viii.1999 (18 days) 18.viii.–03.ix.1999 (16 days)	21.viii.–03.ix.2000 (13 days)
third instar fourth instar (only one larva)	24./29.viii.1999 – 20./22.iv.2000 (ca. 8 months) 03.ix.1999–21.iv.2000 (ca. 8 months)	03.ix.2000–30.iv.2001 (8 months)
feeding stop	between 05.–10.ix.1999	15. or 16.ix.2000
diapause	7 months	7 months
regaining activity	14.–17.iv.2000	between 15.–18.iv.2001
fourth instar fifth instar (only one larva)	20.–22.iv. – 28./29.iv.2000 (7–8 days) 21.iv.–30.iv.2000 (9 days)	30.iv.2001–07.v.2001 (7 days)
final instar (incl. prepupal phase) final instar (only one larva)	28.–29.iv. – 16./18.v.2000 (18–19 days) 30.iv.–19.v.2000 (19 days)	07.v.–28.v.2001 (21 days)
termination of feeding	9.v.–12.v.2000	19.v.2001
pupa stage 1 – male 2 – male 3 – male 4 – female 5 – female	16.v.–05.vi.2000 (20 days) 17.v.–07.vi.2000 (21 days) 18.v.–07.vi.2000 (20 days) 18.v.–11.vi.2000 (24 days) 19.v.–11.vi.2000 (23 days)	28.v.–22.vi.2001 (25 days)

leaves, flower buds, and finally, from the end of April till mid May, on flowers (Figs. 4, 5). During the flowering period of *C. ruthenicus* larvae were reluctant to feed on leaves, and they only did so when flowers were not supplied to them. The green and green-yellowish larvae with black head and single bright lateral stripes grew to a length of over 15 mm. After they stopped taking food they became slightly glittering, started to wander, and finally, prior to pupation, they tended to hide themselves under plant fragments on the box floor. They linked plant fragments with delicate threads and fixed themselves to them by a girdle. The larval stage lasted over 9.5 months altogether. The pupae, about 12 mm in length, were yellow-greenish and amber (Fig. 6). No pupa shed the larval cuticle from the last segments of the abdomen. The pupal stage lasted 3–3.5 weeks (Figs. 6, 7). Imagines emerged in the first half of June. Males were the first to emerge (Fig. 8). Attempts at inbreeding failed. Eggs (Fig. 1) laid by one female were not fertilised.

Second part of the study. Based on the observations gathered in the laboratory, immatures were searched for in the locality of Grzybowce (UTM: FD88). The following specimens and traces of *P. eroides* in the field were found:

- 10.vii.2000 – two eggs were found on leaves of *C. ruthenicus*.
- 13.viii.2000 – fragments of egg covers, one larva of several days old, and one egg on the upper side of a leaf of *C. ruthenicus* were found; circular feeding spots were found on leaves (similar to those observed in the lab rearings but fewer per leaf than documented on Fig. 2).
- 20.vii.2001 – two eggs were found on leaves of *C. ruthenicus*; a male was observed exactly at the same place as on 03.vii.1999; it was flying and nectaring on flowers of *Thymus serpyllum*.

From the egg found on 13.viii.2000 a male of *P. eroides* was reared (the chronology of the rearing events is presented on Tab. 1). Thus, the eggs found in the field were confirmed to have been correctly identified. The following facts were also noted. During the first and second moults (before hibernation), the larvae positioned themselves on the main vein, on the upper side of leaves. During the fourth moult (in May), one surviving larva was sitting on the lower side of a flower bud with the head pointed towards the stem. One egg found on 10.vii.2000 was parasitised but the parasitoid was not identified.

Thus, the above research identified *Chamaecytisus ruthenicus* (Fisch. ex Woł.) Klásk. (Fabaceae) as a larval hostplant of *Polyommatus eroides* in north-eastern Poland.

The locality of Narejki (UTM: FD98), where the female was captured to initiate the rearing, is a new locality for *P. eroides*. Both sexes of that species were flying in a dry pine forest clearing. In the vicinity, there are several 12-year-old pine trees, separated by barren and grassy spots. In that slightly hilly area *C. ruthenicus* grows at the edges and inside the forests, but also in the clearings. At the time of occurrence of *P. eroides* three individuals of *Colias myrmidone* (2♂ and 1♀) were also observed. The locality is situated at about 2 km from the Belarus border.

Three species of ants visiting *C. ruthenicus* flowering stems in May (collected on 27.v.2004 at the locality of Grzybowce) were identified. These are: *Formica (Serviformica) cinerea* Mayr, 1853 (Formicidae), *Myrmica ruginodis* Nylander, 1846 (Formicidae) and *Tetramorium caespitum* Linnaeus, 1758 (Formicidae).

Discussion

Despite specific searches in the field, no larvae feeding on flowers in the spring were found and no interactions of larvae with ants were recorded, although facultative myrmecophily is possible. The three species of ants mentioned above are reported to tend lycaenid larvae and facultative myrmecophily within the genus *Polyommatus* is well known (Fiedler & Bálint 1992; Fiedler 1995). Tolman (1997) mentioned that *Tapinoma* sp. ants attend *P. eroides* caterpillars.

Chamaecytisus ruthenicus is a larval hostplant for *P. eroides* populations living in dry, young pine forests. Although the observation concerns only Poland, it is highly probable that *C. ruthenicus* is also a larval foodplant in neighbouring Belarus where *P. eroides* occurs in a similar habitat –young pine plantations (van Swaay and Warren

1999). The flowering period of *C. ruthenicus* lasts from April through June. That plant reaches the north-west limit of its range in Poland. It is also distributed in Belarus, Ukraine, reaching Crimea, the Caucasus, and west Siberia (Kostrakiewicz 1959). As mentioned in the Introduction, *Oxytropis* sp., *Astragalus* sp. (van Swaay and Warren 1999), and *Genista depressa* (Tolman 1997) were reported as larval foodplants for *P. eroides*. *Genista depressa* does not occur in Poland; it occurs in Ukraine and Bulgaria (Kostrakiewicz 1959). The way larvae feed on that plant, as described by Tolman (1997), is similar to that which I observed on *C. ruthenicus*. Although *Oxytropis pilosa* and *Astragalus* sp. (several species) do exist in the Puszcza Knyszyńska Forest (Sokołowski 1995), I have not observed *P. eroides* on these species in this region so far. It is possible that for the population of *P. eroides* inhabiting regions to the south-west of the Puszcza Białowieska Forest (Buszko 1997) there may be another larval foodplant closely related to *C. ruthenicus*, such as *Chamaecytisus ratisbonensis* (Schaeff.) Rothm. (Fabaceae), for which the flowering time is also from April through June, and which similarly reaches in Poland the north-west limit of its range. Nevertheless, *C. ruthenicus* reaches the Puszcza Knyszyńska Forest and its eastern vicinity (Sokołowski 1995; Zając & Zając 2001) while *C. ratisbonensis* only the Puszcza Białowieska Forest (Zając & Zając 2001). Interestingly, I observed individuals of *P. eroides* at sites where *Colias myrmidone* also was present.

I hope that my work will result in efforts being undertaken to preserve this beautiful endangered lycaenid. There is obvious evidence that further research is needed but the very low density of this *P. eroides* population will make it a serious difficulty. I have seen several males and only one female in the field so far.

Acknowledgements

I am grateful to Dr. Chris van Swaay for information on the hostplants and habitats of *P. eroides*. I thank Dr. Jacek Chobotow for taking the photograph of the eggs and Dr. Anna Stankiewicz for identifying the ants.

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(ISBN: 3-931374-22-X). € 90.00. (in German)

This new volume of the „Microlepidoptera Palaearctica" series is dedicated to *Stenoptilia* Hübner, 1825, which is the largest pterophorid genus in the Palaearctic region with 84 species. The larvae of the species included in *Stenoptilia* feed on certain Asterids and Saxifragaceae.

„Pterophoridae III" starts with a short preface by the editor and a short introduction by the author. These are followed by a list of the species sorted by larval host-plant, and a systematic checklist of *Stenoptilia* species sorted by species groups, with the page and figure numbers where the taxa are treated in the book.

The systematic part starts with a key to the pterophorid tribes and a description of the genus *Stenoptilia*, including nomenclatural information, full synonymy and a key to its species. Within *Stenoptilia*, the author distinguishes five species groups characterised by their larval association to certain plant families, because morphological evidence is missing to support species groups in *Stenoptilia* otherwise.

For each species, the full synonymy with the reference to each original description and the type locality of each species-group taxon are given. A comprehensive list of the references in which each species was treated is provided. The descriptions of the species comprise the external characters of the adults, and their male and female genitalia; the number of specimens investigated is also stated. The life history is described with data on the host-plants of the larvae, where to find the eggs, larvae and pupae, and the phenology and habitat. A brief description of the preimaginal stages is included here as well. The distribution is provided in details by country and provinces and summarised in a table at the end of the systematic part, therefore providing a quick overview of the countries in which each species occurs. The book concludes with a list of the references used, plates with black & white drawings of male and female genitalia, as well as the usual and beautiful colour paintings of the moths by František Gregor, which have made the „Microlepidoptera Palaearctica" series so famous. An index to scientific names of Pterophoridae at the end of the book enables the user to find the text and figures of every taxon quickly, which makes the book easy to use.

„Pterophoridae III" is a contribution that gives an overview of all species of *Stenoptilia* from the Palaearctic region. The user will be enabled to identify the species sufficiently, though the genitalia drawings are of simple standard. It was not clear to me why one species, *S. mengeli* Fernald, 1898, was included because it is confined in distribution to the Nearctic region, where more species of this genus occur. Nevertheless, the book can be recommended to all who are interested in the systematics and life history of Pterophoridae and in the fauna of the Palaearctic region. Let's hope that the treatment of the Pterophoridae will be completed one day within the „Microlepidoptera Palaearctica" book series.

Matthias Nuss

Taxonomy of *Rhodostrophia jacularia* (Hübner, 1813) – a Sterrhinae moth with variable female wing shape (Lepidoptera: Geometridae)

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Abstract. The phenomenon of gradual transformation of the wing shape and size in the Palaearctic sterrhine moth *Rhodostrophia jacularia* (Hübner, 1813) is described (Geometridae). The females of this species have shorter wings than the males throughout the species' distribution area, but they are capable of flying, apart from a mountain population in the Russian Altai near the Chinese and Mongolian border. These earthbound females run and jump on the ground and their facies is characterized by concave wing margins and smaller wing surfaces, unlike other specimens studied. The taxonomy of *R. jacularia* is revised, and a neotype is designated for *R. jacularia* because the original syntype(s) has been lost. *R. jacularia* ssp. *minor* Alphéraky, 1892 **syn. n.** and *R. tyugui* Vasilenko, 1998 **syn. n.** are downgraded to the synonymy of *R. jacularia*. *R. jacularia* is redescribed, the adults and genitalia are illustrated and a distribution map of the species is given.

Key words. Lepidoptera, Sterrhinae, *Rhodostrophia*, narrow-winged, female, new synonyms, taxonomy.

Introduction

Modification of the wing shape has taken a variety of forms. Within Geometridae a well-documented and widespread example of this is brachyptery, or reduction of wing length. This feature is restricted to the females only and it is considered a derived state that has evolved independently many times, and it has been reported to occur at least in the subfamilies Alsophilinae, Larentiinae and Ennominae (Pellmyr 1980; Hausmann 2001; Sattler 1991). Brachyptery is most widespread among species that live as adults under cold conditions, i.e. they appear in early spring or late autumn.

So far, there has been no record of brachyptery in Sterrhinae, although other wing modifications, namely sexual dimorphism, is widespread in the subfamily, and in many instances the females have shorter wings compared to males. To mention a few examples, this is well seen in the European Sterrhini species *Limeria macraria* Staudinger, 1892 and *Idaea attenuaria* (Rambur, 1833) (Hausmann 2004). The reduction of wing length is pronounced in *Scopula (Stigma) kuldschaensis* (Alphéraky, 1883) (Scopulini) also, whose female is not only smaller than the male but it is also very reluctant to fly at all (Prout 1912–16; Sihvonen 2005). Other wing shape modifications of Sterrhinae have not been reported. In the summer of 2000 a Finnish lepidopterological expedition was made to the Altai Mountains, Russia, where a large number of *Rhodostrophia jacularia* (Hübner, 1813) specimens were collected from a high altitude locality. The females of this population differed from other known populations by having narrow wings with concave margins, and the specimens did not fly at all. Instead, if disturbed, the specimens ran and jumped on the ground like spiders.

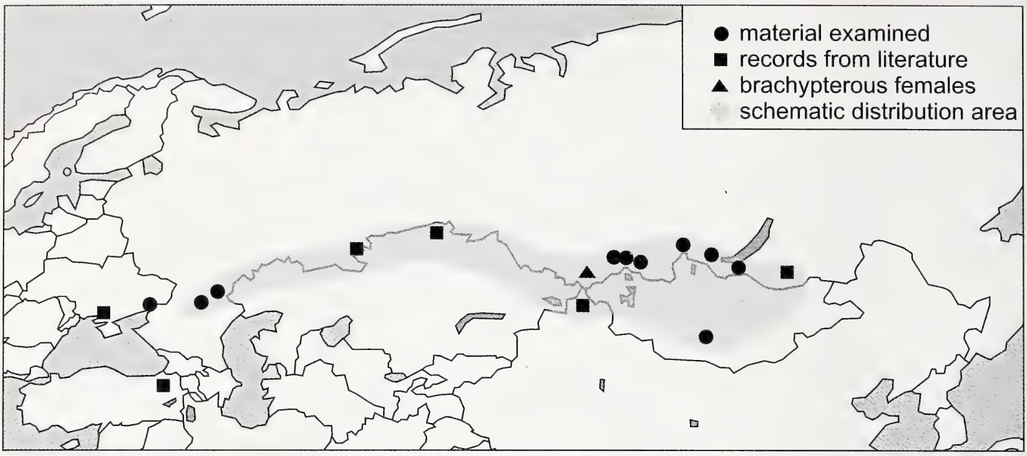


Fig. 1. Distribution area of *Rhodostrophia jacularia.* Literature records (black square): Vojnits 1976; Kostjuk et al. 1994; Riemis 1994; Viidalepp 1996; Hausmann 2004.

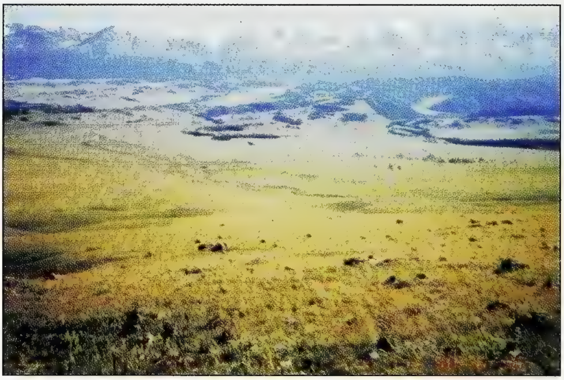


Fig. 2. Habitat of *Rhodostrophia jacularia* in Altai mountains, Russia (Kuraisky range, 2500 m), where narrow-winged females were found. Locality is dominated by *Artemisia* spp. (Asteraceae). Photo: Kari Nupponen, 26.vi.2000.

The description of *Rhodostrophia jacularia* is based on a specimen(s) whose type locality is given imprecisely as 'Europe'. The type specimen(s) has been lost but they probably originate from the lower Volga Region, Russia, because all the known old records of this species, i.e. those from the 18th century, are from that area. A closely related species to *R. jacularia* has been described from the Altai Mountains, Russia, namely *R. tyugui* Vasilenko, 1998. The description is based on males only, and the species was diagnosed to be separated from *R. jacularia* using structures of the male genitalia only: (roughly translatated from Russian): 'the valva of new species [*tyugui*] resembles that of *jacularia*, but it is considerably larger and has more massive sacculus, and by the structure of costa. In *tyugui* the margin of costa is round (in *jacularia* it is right-angled)'. Hausmann (2004) diagnosed the *jacularia* species-group and considered it to have three species: *jacularia* (Hübner), *tyugui* Vasilenko, 1998 and *solitaria* (Christoph, 1887). The species group is characterised by dark and undulated fasciae of the forewings, male hindtibia that has four spurs, valva of the male genitalia that is flat and phallus that has a single cornutus. Further, the female genitalia has short and stout apophyses anteriores and papillae anales are usually spinose.

Thus far, both sexes of *R. jacularia* are reported to be fully-winged although females tend to be slightly smaller. The wingspan of the males is between 25–28 mm, whereas those of the females is between 23–25 mm (Hausmann 2004). Both sexes are attracted to light and the females are capable of flying although the female ratio at light is very low, between 5–10%.

In this paper we review the taxonomy of *R. jacularia* and show that the above-mentioned diagnostic characters of *R. tyugui* are suspect. We also present material from the Altai Mountains, Russia, where a population of *R. jacularia* was found, whose females have markedly narrower wings, quite different in shape to other known specimens. These females are not capable of flight unlike specimens from other populations.

Material and conventions

Specimens have been studied from the following collections (acronyms after Evenhuis & Samuelson 2005):

coll. Nupponen	Private collection of Kari Nupponen, Espoo, Finland
FMNH	Finnish Museum of Natural History, Helsinki, Finland
SZMN	Siberian Zoological Museum,Institute of Animal Systematics and Ecology, Novosibirsk,Russia
ZIN	Zoological Institute, Russian Academy of Sciences, St Petersburg, Russia

Further, a large population sample from the Altai Mountains, Russia (coll. Nupponen), was studied, where *R. jacularia* occurs sympatrically with *R. tyugui.*

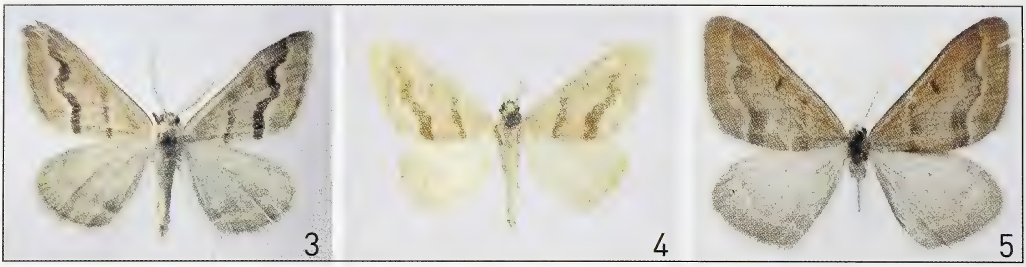
Specimen data are provided as they appear on the labels. Information from each type specimen is enclosed within single quotation marks, a vertical line with a space on each side separates lines of the label, a semicolon separates the labels, information enclosed by angled brackets includes comments and square brackets provides further details about the specimen or label.

Rhodostrophia jacularia (Hübner, 1813) Figs. 1–15

Geometra jacularia Hübner, 1813: pl. 84 fig. 431. Type locality: Europe (probably lower Volga region).

Eusarca jacularia var. *minor* Alphéraky, 1892: 71. Type locality: Western China: Ordosse, Tai-tou-ahi, near River Oulane-Morine. **syn. n.** Scoble 1999 (*Rhodostrophia acularia* ssp. *minor*).

Rhodostrophia tyugui Vasilenko, 1998: 1138, figs. 2, 4. Type locality: Russia, Altai, South Chyua Range. **syn. n.**



Figs. 3–5. Type specimens of examined material. **3.** *Rhodostrophia jacularia* (Hübner, 1813). Neotype from Sarepta, Russia (FMNH). **4.** *Rhodostrophia jacularia* var. *minor* (Alphéraky, 1892). Lectotype from western China, Ordosse (ZIN) (photo: Fritz, Erlacher & Hausmann, Zoologische Staatssammlung München). **5.** *Rhodostrophia tyugui*, Vasilenko, 1998. Holotype from Altai mountains, Russia (SZMN) (photo: Vasilenko, Siberian Zoological Museum, Novosibirsk).

Material. *Geometra jacularia* Hübner, 1813. Syntype(s) lost. – *Rhodostrophia jacularia* (Hübner, 1813). Neotype ♂ (Fig. 3) (hereby designated; external appearance of the selected neotype agrees with the specimen that is illustrated in the original description of this species by Hübner). Labelled: 'NEOTYPE | Rhodostrophia ♂ | jacularia (Hübner, 1813) [red rectangle label]; 22.6 [18]94 | S[a]r[e]pta' (FMNH). – *Eusarca jacularia* var. *minor* Alphéraky, 1892. Lectotype ♂ (Fig. 4) (designated by Hausmann 2004). Labelled: 'Lectotypus: ♂ | Rhodostrophia | jacularia minor | Alphéraky | design.: [red rectangle label]; v. minor | Alph | ♂[green rectangle label]; VIII 1884 | Ordos <western China, Ordosse, Tai-tou-hai, near River Oulane-morine> | Potanine [green rectangle label]; 85; Zool. Inst. | Acad. Sci. USSR | Leningrad' (ZIN). – *Rhodostrophia tyugui* Vasilenko, 1998. Holotype ♂ (Fig. 5) Labelled: 'HOLOTYPUS | Rhodostrophia tyugui | sp. nov. | S.V. Vasilenko det. [red rectangle label]; RUSSIA, Altai Republic | South Chuya Range | river Kokuzek headwater, locality Kyp, 2500 m | 30.VI. 1982 (Yu. E. Perunov leg) [in Russian]' (SZMN).

Rhodostrophia jacularia. 485♂ (12 genitalia), 30♀ (7 genitalia). **Russia**. Tuva republic, several locations: 71♂ (1 genitalia) Irbitei [50°44'N 93°08'E, 1000 m]; 1♂ Erzin [50°16'N 94°54'E, 1250 m]; 8♂ Kholoozha [50°45'N 94°29'E, 1250 m]; 10♂, 2♀ (2 genitalia) Ust-Ujuk [52°04'N 94°22'E, 670 m]; 26♂ Kyzyl [51°43'N 94°27'E, 700 m]; 3♂ Tannu-Ola mts. [50°45–50'N 92°29–94°19'E, 1250–2000 m]; 8♂ (1 genitalia), 2♀ (1 genitalia) Sarepta, 15.vi.[18]94, coll. Duske; 2♂ Irkut, coll. Duske; 2♂ Munko Sardyk, Sajan mt.; 1♂ Saratow, coll. Winter; 1♂ Ross., mer., Staudinger (all in FMNH). 2♂, 2♀ Volgograd district, Volgograd 80 km NW, near Ilovla village, sandy steppe, 02.vi.2001; 2♂, 2♀ Volgograd oblast, Frolovo village 20 km SW, sandy steppe, 16.–17.v.2005; 330♂ (6 genitalia), 20♀ (3 genitalia) Altai mountains, Kuraisky hrebet, 50°16'N 87°50–55'E, 1500–2500 m, 25.vi.–4.vii.2000; 9♂ (2 genitalia), 2♀ (1 genitalia) Altai mnts, Kuraiskaja steppe, 50°16–20'N 87°50–55'E, 1500–2800 m, 05.–11.vii.2001; 6♂ (2 genitalia) S-Buryatia, Hamar Daban mnts, Murtoy river, village 6 km NW of Gusinoe ozero, forest steppe, 51°11–13'N 106°10–12'E, 700 m, 19.vi.2002; 2♂ S-Buryatia, lake Gusinoe ozero, steppe, 51°09'N 106°16'E, 550 m, 18.vi.2002 (all leg. et coll. T. & K. Nupponen). 1♂ **Mongolia**, Omnogov, Aimak, Bayandalai, Somon, Zoolon uul, 1700 m, 43°21'N 103°11'E, 27–30.5.1997, Yu. Marusik (FMNH).

Rhodostrophia tyugui. 6♂ (3 genitalia) **Russia**, Altai mountains, Kuraisky hrebet, 50°16'N 87°50–55'E, 1500–2500 m, 28.vi.–3.vii.2000, T. & K. Nupponen leg. (coll. Nupponen).

Redescription. Measurements. Forewing length ♂ 14–18 mm, ♀ 12–14 mm.

Head. Labial palpi with erect, flat scales, light brown. Proboscis long. Front dark brown; interantennal ridge, scape, collar, antennae above light brown. Male antennae bipectinate, female antennae filiform.

Thorax. Thorax and legs beige except fore- and midleg femur and tibia dark brown cephally; male and female hind tibia with 2 + 2 spurs. Forewing colour variable, from light brown to dark brown to red brown; transverse lines wide, brown; transverse anterior line slightly concave, inner margin bordered with white; transverse posterior line wider, undulate, outer margin bordered with white; terminal line weakly developed,

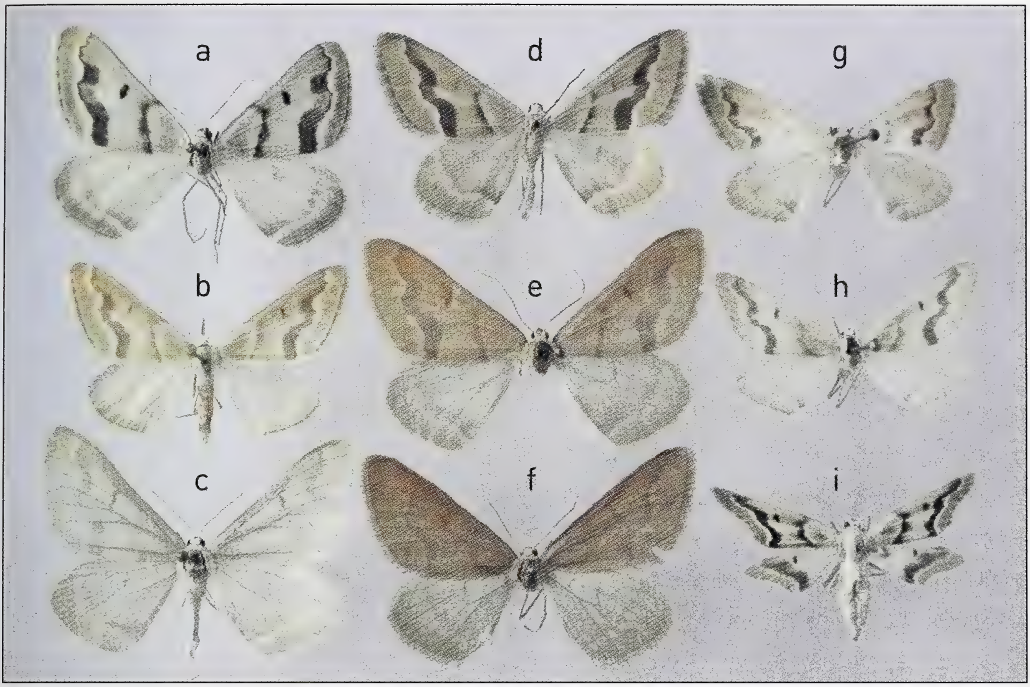
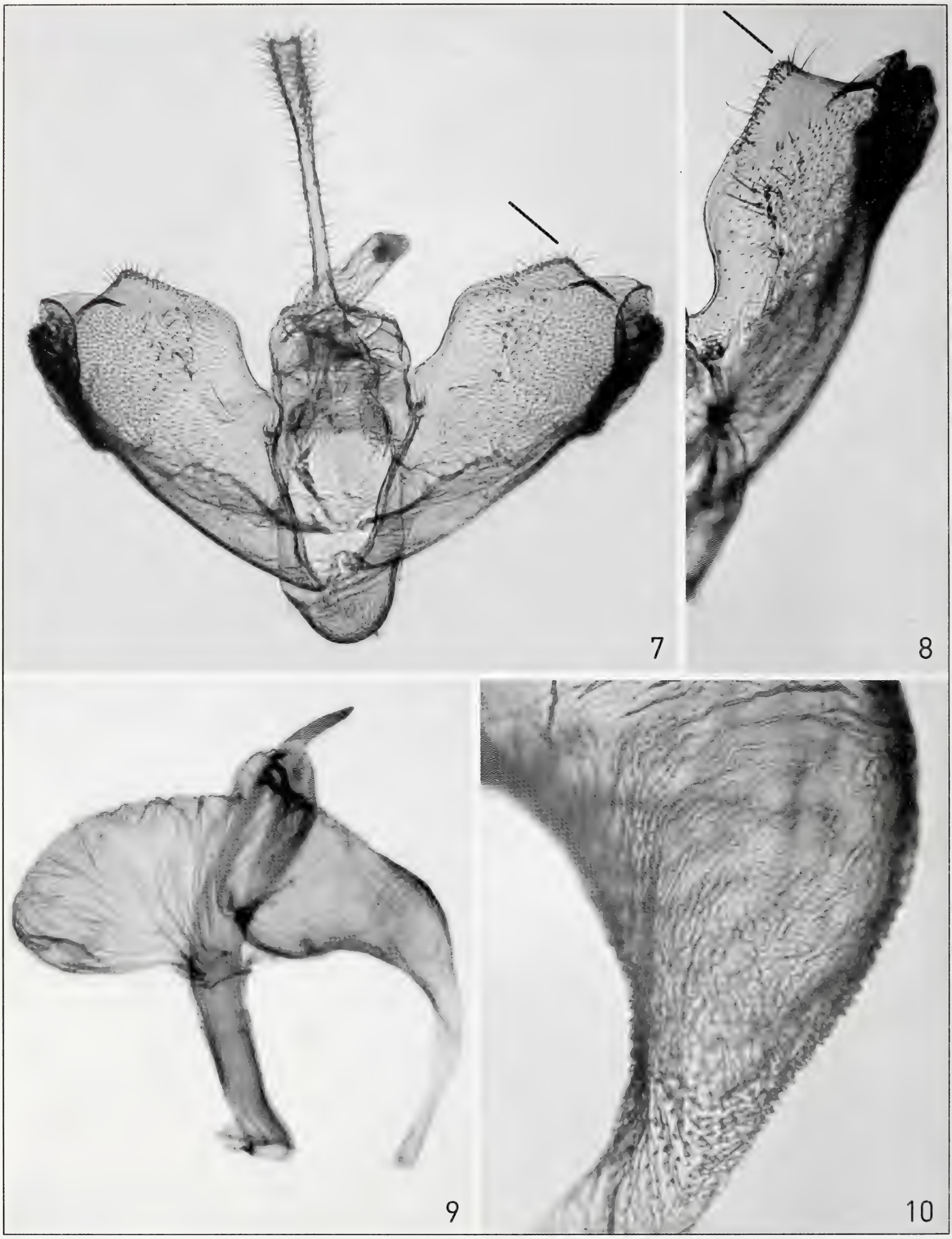


Fig. 6. Variation of external appearance of *Rhodostrophia jacularia*. **a.** ♂, Russia, Altai mountains (coll. Nupponen), **b.** ♂, Russia, Tuva, Tannu-Ola mountains (FMNH), **c.** ♂, Russia, Altai mountains (coll. Nupponen), **d.** ♂, Russia, Irkutsk (FMNH), **e.** ♂, Russia, Altai mountains (coll. Nupponen), **f.** ♂, Russia, Altai mountains (coll. Nupponen), **g.** ♀, Russia, Sarepta (FMNH), **h.** ♀, Russia, Tuva, Ust-Ujuk (FMNH), **i.** ♀, Russia Altai mountains (coll. Nupponen).

dark brown, complete; fringes concolorous with wings; discal spots distinct, round, brown. Hindwings paler; only transverse posterior line visible, outer margin bordered with white; wing margins of narrow-winged, brachypterous females concave. Wings below without markings.

Abdomen. Abdomen coloured as thorax and wings, light brown. Tympanal organs large, also in female; ansa narrow at base, widens above it, tip hammer-headed; medial pouch between cavi tympani absent. Sternites 3–7 and tergites 1–7 of male weakly sclerotized, undifferentiated; anterior margin of male 8th sternite with round, weakly sclerotized area, posterior margin with two round lobes, medially invaginated; male 8th tergite with narrow medial ridge (Fig. 11). Female sclerites undifferentiated.

Male genitalia (Figs. 7–10). Uncus long, narrow, slightly bifid at tip, setose apically. Tegumen weakly sclerotised. Gnathos fused, bare. Valva broad, concave, dorsal margin markedly bent, angle at costa margin appears different if viewed from different angles (Figs. 7, 8); ventro-terminal margin strongly spinose. Juxta plate-shaped. Transtilla fused, sclerotised, straight, wide plate. Vinculum small, margin evenly round. Phallus (Fig. 9) round, bent ventrally, apex with strong, cornutus-like projection; caecum small, round ending. Vesica (Fig. 9) without cornutus, large, opens ventrally, with three large diverticula, one dorsal and two lateral; dorsal and left lateral



Figs. 7–10. Male genitalia of *Rhodostrophia jacularia*. **7.** PS1015, valvae spread open but not pressed flat as in Fig. 15. **8.** PS1015, right valva, valva not spread open. **9.** PS1015, phallus in lateral view. **10.** PS1015, base of ductus ejaculatorius.

Shape of sacculus margin was used as a diagnostic feature by Vasilenko (1998) to separate *R. jacularia* and *R. tyugui*. Appearance of the costa margin depends on the angle from which the valva is examined (indicated in Figs. 7, 8).

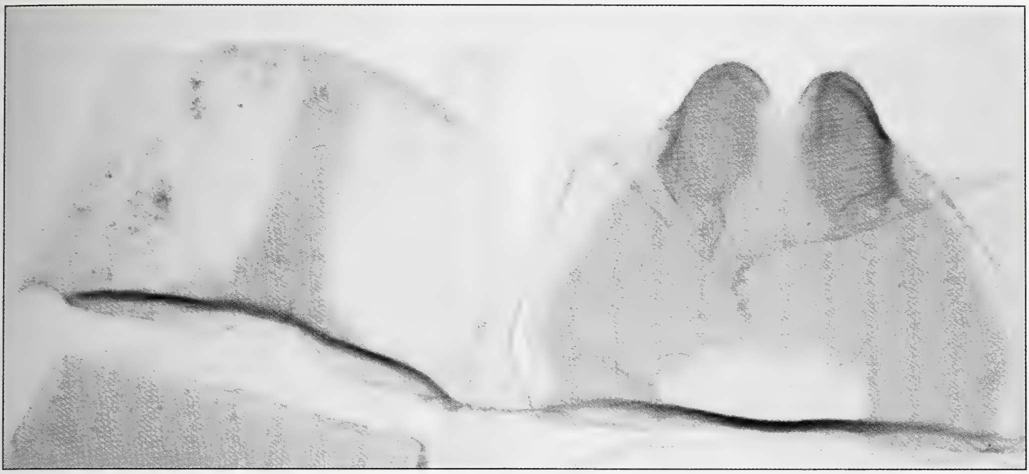
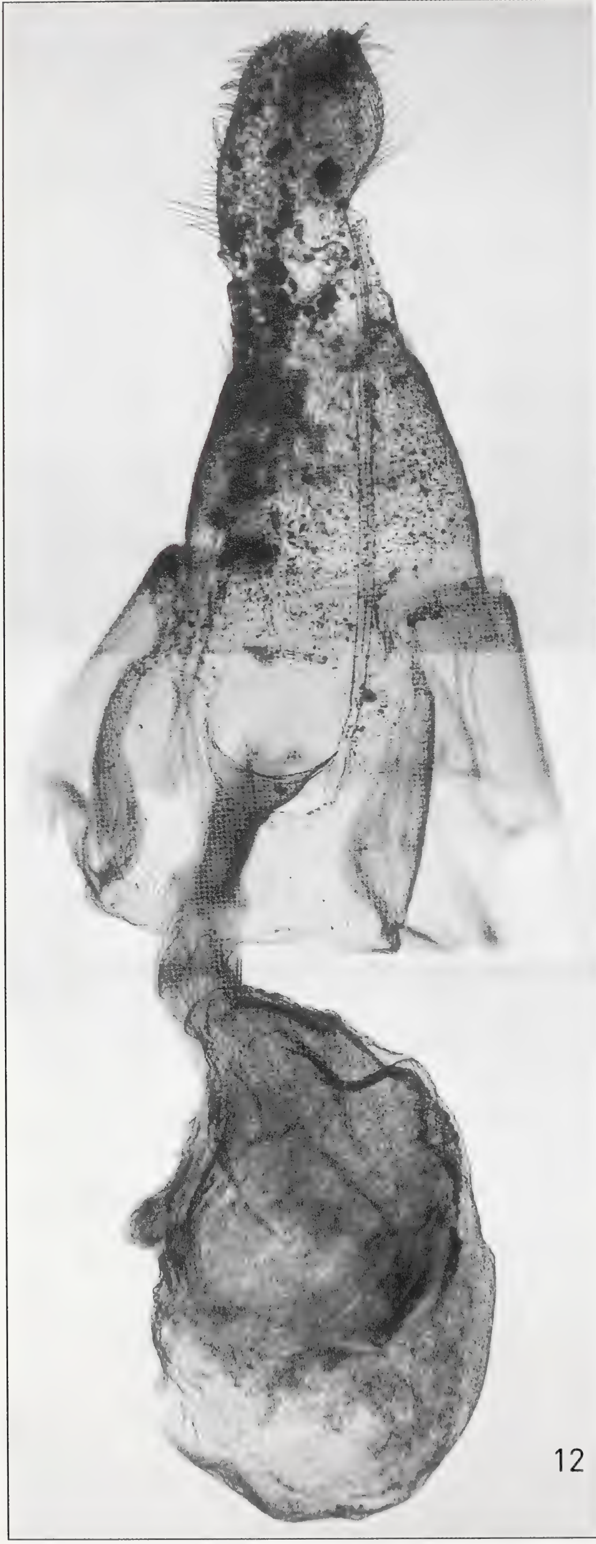


Fig. 11. *Rhodostrophia jacularia* ♂, PS965, 8th abdominal segment.

diverticula (when viewed dorsally) round, invaginated; right lateral diverticulum straight, tube-form, turns ventrally at distal end; ductus ejaculatorius opens from distal end of right lateral diverticulum, heavily serrated at base (Fig. 10).

Female genitalia (Fig. 12). Papillae anales rounded, fused, surface smooth; several laterally pointed spines caudally. Apophyses posteriores stout, straight, long; apophyses anteriores about 1/3 length of apophyses posteriores. Lamella postvaginalis absent; lamella antevaginalis a small, round plate; large membraneous invaginations laterally on 7th sternite. Ostium bursae in distal margin of 7th sternite, ventral margin sclerotised, round; ductus bursae sclerotised, round; ductus seminalis wide at base, opens from junction of ductus bursae and corpus bursae; corpus bursae round, elongated, two membraneous invaginated sacs dorsolaterally; signum horseshoe-shaped (Figs. 13–14).

Variation (Fig. 6). Sexually dimorphic species; females smaller, wings narrower and outer margin convex or concave. The thickness and colour of the transverse lines and the shape of the discal spots varies on the wings. The ground colour varies continuously from light brown (e.g. Sarepta) to dark brown (e.g. Altai, Irkutsk) to red-brown (Altai). The discal spot shape varies from lunular (e.g. Sarepta) to ovoid (Altai, Mongolia). Males from Altai are the largest and the forewing shape is rounded. A number of specimens from South Buryatia and Sarepta have a distinct white wedge-shaped area in forewing. The amount of intrapopulation variation in the external appearance of males in the Altai Mountains (Kuraisky range) (n=336) is large (Figs. 6a, c, e, f). Light brown is the dominant ground colour (n=325), transitional light brown-red brown (n=5) and red-brown (n=6) are considerably fewer. Females from Sarepta have a triangular wing shape and the wing margin is convex (Fig. 6g) whereas females from Altai have narrow, elongated wings and the wing margin is concave (Fig. 6i). There is little variation in the male and female genitalia.



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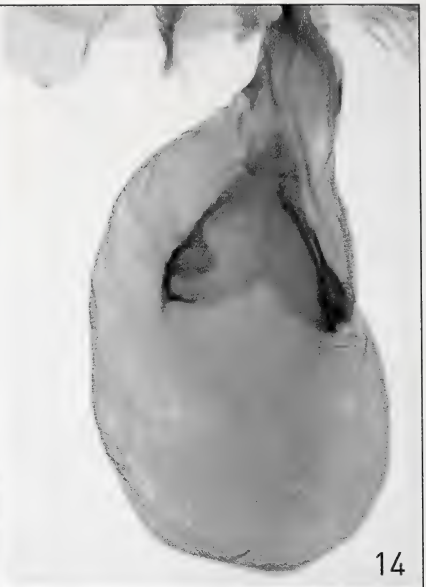

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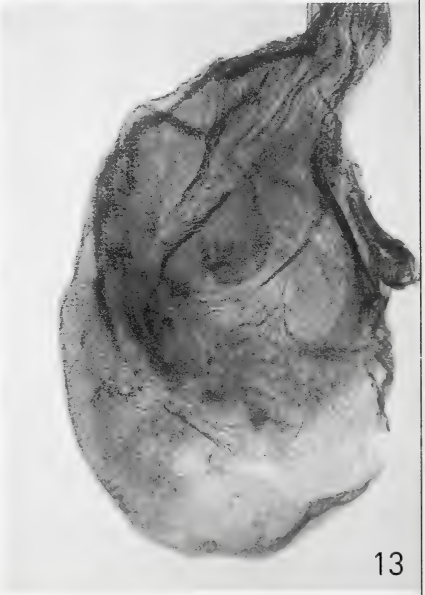

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Figs. 12–14. Female genitalia of *Rhodostrophia jacularia*. **12.** PS848, ventral view. **13.** PS848, corpus bursae in dorsolateral view showing membraneous invaginated sacs (transmitted light image). **14.** PS1016, corpus bursae in dorsal view showing horseshoe-shaped signum (stereo microscope image).

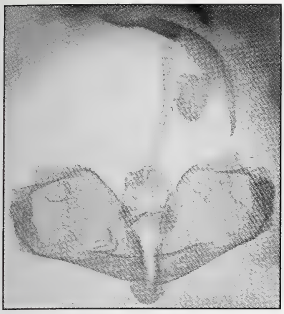

Fig. 15. Male genitalia of *Rhodostrophia tyugui*, a junior synonym of *R. jacularia*. Valvae are spread open fully, i.e. pressed flat, unlike in Fig. 7. Juxta is attached to phallus (upper right hand corner) (photo and slide: S. Vasilenko).

Discussion

Thus far, the morphologically distinct females that have narrow wings and concave wing margins are known from a single population of *R. jacularia* only. The associated, reduced ability to fly need not be confined to the Altai mountains only, but it may be a more widespread phenomonon within this species. Even in the areas where females are fully-winged, the female ratio at light is usually low, about 10%, and it may be an indication of this. There are several examples known within Geometridae where females are fully winged but are reluctant to fly, e.g. *Lycia hirtaria* (Clerck, 1759) (Ennominae, Bistonini) and *Lipomelia subusta* Warren, 1893 (Sterrhinae, Scopulini).

We have shown that variation in the external appearance of *R. jacularia* is a continuous character, ranging from light brown to red-brown (Fig. 6). Therefore we conclude that ground colour can not be used as a diagnostic feature to separate *R. tyugui* from *R. jacularia*. Further, the diagnostic difference of the costa margin of the male valva, i.e. the degree of the angle, as presented by Vasilenko (1998), depends on the angle from which the valva is examined. We consider this quantitative character artificial and uninformative at separating taxa at the species level (Figs. 7, 8). Similarly, the general appearance of the valva, including its shape and width, depends upon how the genitalia preparation has been made. If the valvae are partly spread open (judging from the angle that the ventral margins of the valvae create), as in Fig. 7, then they appear to be much narrower than if they are fully spread open (Fig. 15). Finally, as was expected, a continuous positive correlation was noted between specimen size and its genitalia. We infer this to explain the observed difference in size between types of *R. jacularia* and *R. tyugui*.

Because we have not found any other diagnostic differences in the genitalia structures between *R. jacularia*, *R. jacularia* ssp. *minor* and *R. tyugui*, we treat all these taxa as conspecific. The subspecies status of *minor* has been disputed already by Hausmann (2004), it is conformed and formally proposed here. It is also worth noting, contrary to Hausmann (2004) that vesica of *R. jacularia* is without cornutus. Apparently, he has mistakenly considered the sharp, elongated projection in the apical part of the phallus as the cornutus. Furthermore, the genitalia structures of the narrow-winged females from the Altai mountains match well with the genitalia of *R. jacularia* from other regions and we therefore consider them to be conspecific with the latter. The conclusion that the specimens from Altai are conspecific with *R. jacularia* is further strengthened by the observation that the males in that region are fully-winged, agreeing with other material examined.

In a few instances there is a correlation between the female wing reduction and the tympanal organs. For example in *Phigalia* Duponchel and *Erannis* Hübner (Ennominae, Bistonini), vestigially winged females have reduced tympanal organs or the structures are absent altogether whereas in males these structures are fully developed (Cook & Scoble 1992). We did not find this in *R. jacularia*, both males and females have fully developed tympanal organs. The variation of the female wing shape in *R. jacularia* is exceptional within Geometridae. We suspect that the exceptional feature of the Altai specimens has developed as an adaptation to local, harsh environmental conditions.

Acknowledgements

Axel Hausmann (Zoologische Staatssammlung, München) and Sergei Vasilenko (Siberian Zoological Museum, Novosibirsk) are thanked for providing photos and data. Our thanks are also due to Vladimir Olschwang (Ekaterinburg, Russia), Alexander Malozemov (Ekaterinburg, Russia) for organizing the Altai expedition, Pekka Vilkamaa (FMNH, Finland) for translation, as well as to Timo Nupponen (Espoo, Finland) for valuable help in collecting the material and to Diane Alaruikka for checking our English. The Lepidopterological Society of Finland supported the study through a travel grant.

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Faunistics of the Epermeniidae from the former USSR (Epermeniidae)

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Abstract. 26 species of Epermeniidae are recorded from the territory of the former USSR. Two of them (*Epermenia wockeella* und *E. vartianae*) are recorded for the first time. New distributional data for 11 species and new life history data for 5 species are given. The genitalia of the male of *E. wockeella* and female of *E. vartianae* are described and illustrated for the first time.

Zusammenfassung. Es werden 26 Epermeniidae-Arten für das Gebiet der ehemaligen UdSSR nachgewiesen, zwei von ihnen (*Epermenia wockeella* und *E. vartianae*) sind Erstnachweise. Für 11 Arten werden Neufunde und für 5 Arten neue Angaben zur Lebensweise gemacht. Die Genitalien der Männchen von *E. wockeella* und der Weibchen von *E. vartianae* werden erstmals beschrieben und abgebildet.

Key words. Lepidoptera, Epermeniidae, former USSR, *Epermenia wockeella*, *E. vartianae*.

Introduction

The family Epermeniidae is the only representative of the superfamily Epermenioidea (*sensu* Kristensen 1999). The phylogenetic relationships with the other superfamilies of the Apoditrysia are still unknown. Some characteristics of the recognized recent genera are known but the complete phylogenetic relationships between the genera are still uncertain. Only for some genera are some autapomorphies apparent. The family is divided into the subfamilies Epermeniinae and Ochromolopinae.

The family contains nearly 100 described species in eight genera, and is known from all faunal regions. The life histories indicate that the larvae live in mines (sometimes only in the first instars) of leaves, or that they skeletonize leaves or feed on seeds, mainly of Apiaceae. There are a few host records in other plant families: Araliaceae, Celastraceae, Epacridaceae, Fabaceae, Loranthaceae, Olacaceae, Pittosporaceae, and Santalaceae.

Data on taxonomy, distribution, and biology were compiled by Gaedike (1979, 1996a), including the hitherto known data from the former USSR. Since then several papers with descriptions of new taxa from various zoogeographical regions have been published (Buvat & Nel 2000; Gaedike & Kuroko 2000; Gaedike 2001, 2002, 2004a, 2004b; Budashkin 2003).

Material and methods

The aim of the following paper is to summarize our knowledge about the recent distribution of the family in a major part of the Palaearctic region, the former Soviet Union. The family was studied in this region only fragmentarily in the past. Information on the faunistics can be found in numerous papers by many authors (Eversmann 1844; Erschoff [= Jershov], N. G. & Fil'd 1870; Erschoff [= Jershov], N. G. 1881; Gjunther 1986; Rebel 1901; Krulikovskij 1907; Schille 1930; Lebedjev 1936; Sovyns'kyj

1938; Gerasimov 1948; Kuznetsov 1960; Merzhejevskaja et al. 1976; Tibatina 1976, 1977; Buszko & Skalski 1980; Kuznetsov & Stekol'nikov 1984; Gershenzon 1988; Kutenkova 1989; Budashkin 1990; Martin 1991; Budashkin & Satshkov 1991; Gaedike 1993; Ivinskis 1993; Kostjuk et al. 1994; Budashkin & Kostjuk 1994; Fal'kovitsh 1994; Bidzilja 1995; Satshkov et al. 1996; Savenkov et al. 1996; Budashkin 1996; Gaedike 1996b; Bidzilja & Budashkin 1997; Shutova et al. 1999; Jurivete et al. 2000; Shmytova 2001; Bidzilja et al. 2001; Bidzilja et al. 2002; Budashkin 2003), but none of these was exhaustive. The two recent keys for the studied territory (Fal'kovitsh 1981; Budashkin 1997) cover the fauna of the Western and Eastern parts, but the Central parts, including the regions of Siberia and Middle Asia, were not treated.

The examination of the material of the Zoological Institute of the Russian Academy of Sciences, St. Petersburg (ZIN) and of the Institute of Animal Systematics and Ecology, Siberian Zoological Musem, Novosibirsk (SZMN), the study of the collections of Finnish entomologists (Russian-Finnish Expeditions) in the Finnish Museum of Natural History, Helsinki (FNMH), and more detailed observations in Crimea enable the presentation of several new distributional records, new data on the biology of some species, and descriptions of the hitherto unknown male of one species and female of another. Previously unpublished distributional records from the distribution file of the second author were included.

Each species in the following list is presented as follows: (1) Name of the taxon with synonymy, (2) Material examined, (3) Distribution, (4) Life history, and (5) References for distributional records. Host plant data are taken from the specimen labels or from literature cited at the end of the paper.

Explanations of Russian words and abbreviations

balka	(gorge)
botsad.	botanicheskij sad (botanical garden)
cvetah	(flowers)
d.	derevnja (village)
gora	(mountains)
gornaja	(mountainous)
g.	gorod (city)
gub.	gubernia (gouvernement – administrative district)
hr.	hrebet (mountain range)
i	(and)
koshenije po ljucerne	(swept from lucerne)
kovyl'no-raznotravnyje stepi	(*Stipa*-steppe with species of different plant families)
kraj	(region – administrative district)
kvarc	(light) (na kvarcj: at light)
les	(forest)
m.	mys (cape)
na	(at, on)
list'jah	(leaves of)
svet	(light)
niz uschel'ja	(bottom of the gorge)
obl.	oblast (region – administrative district)

okr.	okres (region – administrative district)
p.	posjokok (settlement)
poljana	(clearing)
pos.	posjokok (settlement)
predg.	predgorje (foothills)
r-n	raion (region – administrative district)
s.	sever (north)
solonchakovaja step’	salt steppe
st.	step’ (steppe)
u podnozh’ja sopki	(foot of the hill)
uschel’je	(gorge)
verhov’ja r.	(upper course)
vyl.	vyletel (emerged)
zapovednik	(nature reserve)

Epermeniidae: Epermeniinae: Phaulernini

Phaulernis Meyrick, 1895: 690

Type species: *Aechmia dentella* Zeller, 1839: 204, by original designation.

= *Aechmia* sensu Stainton, 1854, nec Treitschke, 1833 [Glyphipterigidae], nec Zeller, 1847 [Heliozelidae]

Phaulernis dentella (Zeller, 1839: 204) (*Aechmia*)

Material. 1♂ **Russia**, Samarskaja obl., Zhiguljovskij zapovednik, Bahilova poljana, vi.1993 (Satshkov); 1♂, 1♀ Tul’skaja obl., Svoboda 20 km W Schjokino (Bol’shakov); 1♂ [Siberia] Myski, Kuzneckij Alatau, 9.vii.1956 (Fal’kovitsch). 5♀ **Ukraine**, Crimea, Karadag, 12.vi.1987 (Zagulajev).

Life history. Larvae in seeds of *Chaerophyllum bulbosum* L., *Ch. temulum* L., *Aegopodium podagraria* L., *Angelica silvestris* L. (Apiaceae). Overwintering as pupa.

Distribution. Central and East Europe, Caucasus, Western part of Siberia.

References. Estonia, Latvia, Lithuania, European part of Russia (Fal’kovitsh 1981: 436; Martin 1991: 35; Ivinskis 1993: 65; Savenkov et al. 1996: 25; Gaedike 1996b: 159; Jurivete 2000: 58), Russia: Kaluzhskaja oblast’ (Shmytova 2001: 90), Western Ukraine (Schille 1930: 224), Eastern part of Crimea (Budashkin 1990: 53), Caucasus and Western part of Siberia (Budashkin 1996: 15). The records from the Russian Far East (Gaedike 1993: 92) refer to *E. sergei* Budashkin.

Phaulernis fulviguttella (Zeller, 1839: 193) (*Oecophora*)

= *Oecophora flavimaculella* Stainton, 1849
= *Oecophora auromaculata* Frey, 1867
= *Phaulernis monticola* Moriuti, 1982

Material. 1♀ **Russia**, Murmansk, Pechenga, 8.vii.1910 (D’jakonov); 1♂ Murmanskaja obl., Pechengskij r-n, okr. Zapoljarnogo, 15.viii.1979 (Sinjov); 2♂, 6♀ Poljarnyj Ural, 110 km E Sejdy, na cvetah *Angelica* sp., 15. et 17.vii.2003 (Lvovsky); 1♀ Jaroslavskaja obl., Tutajevskij r-n, okr. d. Gorazdovo, les, 27.vii.1995 (Klepikov); 4 specimens, Petrosawodsk (Günther); Caucasus: 1♂ Kabardino-Balkarija, zapovednik, Bezengi, 5.vii.1997 (Bolov); 1♂ Kabardino-Balkaria, uschel’je Haznidon, 27.vii.1997 (Bolov); 2♀ Dombai, 2240 m, Lake Mussa Atschitara, 1.viii.1976 (Eichler); 2♀ Teberda, 1300 m, 29.vii.–11.viii.1976 (Eichler); 2♂ Kamchatka, 8 km W-S-W Ust’-Bol’sherecka, na list’jah *Ligusticum scoticum*, 10.viii.1992 (Kosterin); 1♂ Kommandeur Islands: Island Mednoj, 12.vii.1927 (Rostovoj). 1♂ **Georgia**, Lagodechi, 23.vii.1961 (Zagulajev).

Life history. Larvae in seeds of *Peucedanum* L., *Angelica* L., *Heracleum* L., *Pimpinella* L., and apparently on *Ligusticum scoticum* L. (Apiaceae). In Lapland the larva lives from July to September, the pupa overwintering (Koponen & Hurme 1986).
Distribution. All Europe, Caucasus, Russian Far East, Japan.
References. Russia: Peninsula Kola (Kozlov & Jalava 1994: 76; Shutova et al. 1999: 22), Northern and North-Western regions of European part (Erschoff & Fil'd 1870: 185), 'Rossia septentrionalis occidentalis' (Rebel 1901: 184), Estonia, Latvia, Lithuania, Karelia, Western Ukraine, Caucasus, Kamchatka Peninsula and Komandorskije Islands (Island Mednyj) (Gjunther 1986: 32; Schille 1930: 230; Fal'kovitsh 1981: 436; Martin 1991: 35; Ivinskis 1993: 65; Gaedike 1993: 93; Savenkov et al. 1996: 25; Gaedike 1996b: 159; Budashkin 1996: 16; 1997: 483; Jurivete 2000: 58).

Phaulernis pulchra Gaedike, 1993: 93–95, figs. 1–4, 12–13

Material. 2♀ **Russia**, Southern Primor'je, 20 km E Ussurijska, Gornotajozhnoje, na svet, 12., 18.vii.1994 (Omel'ko); 1♀ Primorskij kraj, 20 km E Ussurijska, Gornotajozhnoje, na svet, 12.vii.1996 (Sinjov); 1♀ Southern Kuril Islands: Kunashir Island, okr. Sernovodska, 13.viii.1967 (Zabello).

Life history. Foodplants of the larvae still unknown.
Distribution. Hitherto known only from the Russian Far East.
References. Russia: Primorje, Kuril Islands: Kunashir (Gaedike 1993: 93–96; Budashkin 1997: 483).

Phaulernis chasanica Gaedike, 1993: 95–97, figs. 5–11

Material. 2♂, 2♀ **Russia**, Southern Primor'je, Lozovyj hr., 22 km NO Nahodki, na svet, 19.–22.vii.1999 (Sinjov).

Life history. Foodplants of the larvae still unknown.
Distribution. Hitherto known only from the Russian Far East.
References. Russia: Primorje (Gaedike 1993: 94–97; Budashkin 1997: 483).

Epermeniini

Epermenia Hübner, 1825: 418

Type species: *Tinea pontificella* Hübner, 1796, by monotypy

= *Calotripis* Hübner, 1825; *Tichotripis* Hübner, 1825; *Chauliodus* Treitschke, 1833; *Lophonotus* Stephens, 1834; *Chauliomorpha* Blanchard, 1840; *Calotrypis* Herrich-Schäffer, 1854; *Heydenia* Hofmann, 1868, nec Förster, 1856; *Cataplectica* Walsingham, 1894; *Epimenia* Kearfott, 1903; *Acanthedra* Meyrick, 1917; *Epermeniola* Gaedike, 1968

Epermenia (*Calotripis*) Hübner, 1825: 424–425

Type species: *Tinea illigerella* Hübner, 1813, designated by Herrich-Schäffer, 1854: 207–208.

Epermenia (*Calotripis*) *insecurella* (Stainton, 1849: 24) (*Elachista*)

= *Chauliodus illigerellus* Stainton, 1848, nec Hübner, 1813
= *Elachista dentosella* Stainton, 1851
= *Calotrypis dentosella* Herrich-Schäffer, 1854
= *Epermenia plumbeella* Rebel, 1915

Material. 1♂ **Lithuania**, Vilnius, 1.vi.1978 (Ivinskis); 1♂ Lervynos, 6.vi.1979 (Ivinskis); 1♂ **Russia**, Rostov-na-Donu, 10.v.1927, koshenije po ljucerne; 1♂ Gornyj Altaj, p. Ulagan, na svet, 8.vii.1989 (Ustjuzhanin); 1♂ Altaj, Shebalinskij r-n, okr. s. Cherga, 21.vii.1995 (Ustjuzhanin); 3♂ Altaj, Kosh-Agachskij r-n, ploskogor'je Ukok, 2200 m, 11., 18., 22.vii.2001 (Bidzilja); 1♂ Jakutsk, bot. garden, 14.viii.1985 (Dubatolov); 1♂ Env. of Lugansk, 28.vi.1929 (Talitzkij); 1♂ Tuva, 16 km N Kyzyla, 1000 m, step', 14.–16.vi.2001 (Ustjuzhanin); 1♂ Tuva, 30 km NW Samagaltaj, predg. E Tannu-Ola, 1500 m, 24.vi.2001 (Ustjuzhanin); 1♂ Tuva rep., 52°04'N, 94°22'E, 670 m, Ust-Ujuk, 3.–5.vi.1995 (Jalava & Kullberg); 2♀ Tuva rep., 50°50'N, 94°19'E, 2175 m, E Tannu-Ola mts., timberline (*Larix*) steppe, 7.–8.vi.1995 (Jalava & Kullberg); 2♂ Uralsk, 18., 19.v.1907 (Bartel); 2♂ Sarepta (Christoph); 1♂ **Kazakhstan**, Zapadnyj Kazakhstan, Petrov, kovyl'no-raznotravnyje stepi, 2.vi.1949 (Martynova); 1♂ Vostochnyj Kazakhstan, Zajsanskij r-n, 5 km S g. Marbutsu, hr. Saur, 25.v.2000 (Ustjuzhanin); 6♂, 5♀ **Turkmenistan**, Central'nyj Kopetdag, Germab, 780 m, 18.–22.vi.1982 (Fal'kovitsh); 1♂ Aschchabatskaja obl., Kara-Kala, 25.v.1952; 1♀ Aschchabatskaja obl., gora Sjunt, 15.v.1953; 1♀ **Georgia**, Suchumi, UV-light, 7.–10.vi.1974 (Eichler); 1♀ **Armenia**, Erevan, 16.–18.vi.1974 (Eichler).

Life history. Larvae on *Thesium* spp. (Santalaceae), the first stages in mines, later on the surface of the leaves.

Distribution. Middle, South and East Europe, Asia Minor, Near East, Mongolia. New record for Tuva.

References. Estonia [the record from Estonia is probably in error], Central, South and Southeast part of the European part of Russia, Ukraine, Caucasus (Martin 1991: 35, under the name *E. plumbeella* Rebel; Fal'kovitsh 1981: 436; Gaedike 1996b: 159); Lower Povolzh'je (Rebel 1901: 179); Western Ukraine (Schille 1930: 226; Buszko & Skalski 1980: 17), South-East Ukraine (Bidzilja et al. 2001: 81); Turkmenia (Kuznetsov 1960: 30); Kazakhstan, Altai Mts., South-West Siberia, Baikal region, Southern Primorje and Jakutia (Gaedike 1993: 97; Kostjuk et al. 1994: 10; Budashkin & Kostjuk 1994: 17; Budashkin, 1996: 12; Budashkin 1997: 483; Bidzilja et al. 2002: 206).

Epermenia (*Calotripis*) *gaedikei* Budashkin, 2003: 57–58

Life history. Foodplants of the larvae still unknown.

Distribution. Known only from the type locality in Uzbekistan and the environs of Dekhanobad and Derbent (Budashkin 2003: 57).

Epermenia (*Calotripis*) *sinjovi* Gaedike, 1993: 99–102, figs. 14–22

Material. 1♀ **Russia**, Zabajkal'je, Ulan-Ude, u podnozh'ja sopki, 1.vii.1956 (collector unknown); 3♀ S. Primorye, 20 km E Ussurijsk, 12., 25.v., 10.viii.1983 (Kozlov); 1♂ Primor'je, GTS, 6.v.1993 (Lvovskij).

Life history. One larva was collected and reared by S. Ju. Sinjov on *Angelica* sp., (pers. comm.) and it seems to be the foodplant.

Distribution. See below.

References. Described from Southern Primor'je, Southern Kuril Islands (Kunashir) and from the Baikal region (Burjatija) (Gaedike 1993: 99–102); later the species was recorded from the same localities and additionally from Kamchatka and South-East Siberia (Budashkin 1996: 12–13, 1997: 483).

Epermenia (*Calotripis*) *chaerophyllella* (Goeze, 1783: 169, Nr. 292) (*Phalaena Tinea*)

= *Tinea testaceella* Hübner, 1813
= *Lophonotus fasciculellus* Stephens, 1834
= *Chauliodus nigrostriatellus* Heylaerts, 1883
= *Epermenia turatiella* Constantini, 1923

Material. 1♂ **Latvia**, Tapiau, 9.v.1912; 2♀ Libau, 16.v.1924 (Brehm); 1♀ Sortavala, 19.vi.1936 (Brandt). 3♂, 2♀ **Russia**, [Kirovskaja obl.], Urshum, 20.iv.1904, 24.v.1908 [Krulikovskij]; NW Caucasus: Dombai, 3.–5.vi.1974 (Eichler); 1♀ NW Caucasus, hr. Azshi-Tau, p. Kamyshanova poljana, 1350 m, 10.–21.viii.1999 (Schurov); 3♀ [Tatarstan], Sarapul, 1.v.1909 [Krulikovskij]; 1♂, 4♀ Petrosavodsk (Günther); 1♀ env. of Vitebsk, 26.v.1969 (Piskunov); 1♀ [East Siberia], Irkutskaja obl., 20 km S Sljudjanki, pik Cherskogo, 1442 m, 11.vi.1983 (Sinjov); 1♂ Irkutsk. 1♂ **Ukraine**, Zaporozhskaja obl., Vol'njanskij r-n, balka Bal'chanskaja 26.vi.1997 (Zhakov). 1♂, 1♀ **Kazakhstan**, Kuzneckij Alatau, Myski, 21.v.1956 (Fal'kovitsh); 2♂ Kazakhstan, 43°5'N, 77°15'E Zalijskij Ala-Tau, Almaatinskij zap., 1700 m, 23.vi., 12.vii.1990 (Kaila & Mikkola). 3♂, 8♀ **Uzbekistan**, 60 km ESE Tashkent, Chatkal'skij zapovednik, 11.–18.vi., 7., 18., 20.x.1992 (Zolotuchin).

Life history. Larvae recorded from many plants: *Chaerophyllum* L., *Conium* L., *Pimpinella* L., *Sium* L., *Seseli* L., *Silaum* Mill., *Angelica* L., *Heracleum* L., *Pastinaca* L., *Daucus* L., *Anthriscus* (Pers.) Hoffm., *Apium* L., *Carum* L., *Sison* L., *Torilis* Adans., *Oenanthe* L., *Levisticum* L., *Peucedanum* L.; the young larvae are miners, the later instars are skeletonizers, they live between leaves that are spun together. Two generations, the imago overwintering.

Distribution. All Europe, Asia Minor and Near East (Syria), Middle Asia and Siberia. New records for East Siberia and from Uzbekistan.

References. Estonia, Latvia, Lithuania (Martin 1991: 35; Ivinskis 1993: 65; Savenkov et al. 1996: 25; Gaedike 1996b: 159; Jurivete et al. 2000: 58), Belarus (Merzhejevskaja et al. 1976: 19), Ukraine (Schille 1930: 226; Gershenzon 1988: 285), the Mountains of Middle Asia, Siberia (Fal'kovitsh 1981: 434, 1994: 273), European part of Russia (Erschoff & Fil'd 1870: 187; Shutova et al. 1999: 22; Erschoff 1881: 220; Gjunther 1896: 32; Kozlov & Jalava 1994: 76; Krulikovskij 1907: 233; Kutenkova 1989: 24; Shmytova 2001: 90; Satshkov et al. 1996: 70), Caucasus, Western Siberia, Middle Asia, Kyrgyzstan, and Kazakhstan (Tibatina 1976: 353, 1977: 158–159; Gaedike 1993: 99; Budashkin 1996: 12; Dovnar-Zapolski 1969: 126).

Epermenia (*Calotripis*) *aequidentella* (Hofmann, 1867: 206–207) (*Chauliodus*)

= *Chauliodus daucellus* Peyerimhoff, 1870

Material. 1♂ **Russia**, Krasnodarskij kraj, okr. Abrau-Djurso, on *Daucus sativus*, e.l. 12.x.1997 (Schjurov); 1♂ Caucasus NW, Fl. Et. Loc. [?] Teberda, 4200 m, 4.viii.1912 (Tschetwerikow). 1♂ **Azerbaidjan**, village Kosporljak, 6.vii.1962 (Zagulajev); 1♂ Talysch, Kyz-Urdy, 8.viii.1932 (Rjabov). 4♂ **Turkmenistan**, Central'nyj Kopetdag, Germab, 780 m, 18. et 22.vi.1982 (Fal'kovitch).

Life history. Larvae on *Libanotis montana* Crantz., *Daucus carota* L., *Meum athamanticum* Jacq., *Anthriscus vulgaris* Pers., *Thapsia villosa* [L.], *Angelica* L., *Peucedanum* L. (Apiaceae).

Distribution. Central and South Europe, Madeira, Canary Islands, Near and Middle East, Mongolia. New record for Caucasus.

References. Without examination of the specimens the records from the older literature (before 1965) are doubtful, because the following species (*E. strictella*) was then regarded as a synonym of *E. aequidentella*. The records from Estonia and Latvia are probably an error (Martin 1991: 35; Budashkin 1996: 12; Gaedike 1996b: 159; Jurivete et al. 2000: 58). Southern part of European Russia (Fal'kovitsh 1994: 273: no material available for examination); Altaj (Gaedike 1993: 97); Altaj and Azerbaidzhan (Budashkin 1996: 12); the record from Western Ukraine (Schille 1930: 226) belongs to *E. strictella*.

Epermenia (*Calotripis*) *strictella* (Wocke, 1867: 209) (*Chauliodus*)

= *Epermenia infracta* Braun, 1926
= *Epermenia sublimicola* Meyrick, 1930
= *Epermenia anthracoptila* Meyrick, 1931
= *Epermenia srictelloides* Gaedike, 1977

Material. 1♂ **Latvia**, Libau, 26.v.1924 (Brehm). 1♂ **Ukraine**, Crimea, Staryj Krym, 2.viii.1913 (Chetverikov). 1♂, 2♀ Crimea, Karadag, na svet, 6.v.1985, 14.ix.1987, 16.x.2002 (Budashkin). 8♂ 5♀ Crimea, Karadag, plato, e.l. *Seseli arenarium* M. B., 26.–31.x.2002 (Budashkin), 1♂ Wolczkow, p. Zaleszcyki, 1.ix.1935 (Toll). 1♂ **Russia**, Kaukasus (Christoph); 1♀ Altaj, Aktash, 2.vii.1998 (L'vovskij). 1♀ S Tuva, 15 km NW pos. Dusdag, 1950 m, na svet, 26.vi.2001 (Ustjuzhanin); 1♀ Tuva, 20 km E Mugur-Aksy, hr. Cagan-Shibetu, 2200 m, 30.vi.2001 (Ustjuzhanin). 4♀ Tuva, 20 km W Mugur-Aksy, 2150 m, lug. step', 1.–3.vii.2001 (Ustjuzhanin); 2♂ Russia, Tuva rep., 52°47'N, 93°18'E, 1230 m, W-Sajan Mts., subalpine meadow/taiga, 20.–22.vi.1995 (Jalava & Kullberg); 1♂, 5♀ Burjatia, 54°47' N, 110°55'E, Bargazin range 920 m, Olso river valley, taiga, 4.–6.vii.1996 (Jalava & Kullberg); 1♀ Burjatia, 54°21'N, 110°12'E, Bargazin valley, Upper Kurumkan river, 700 m, 1.vii.1996 (Jalava & Kullberg); 2♀ Burjatia, 55°01'N, 111°08'E, Bargazin valley, Umhoj, 600 m, hot springs, 9.vii.1996 (Jalava & Kullberg). **Georgia**: 1♂, 5♀ Borshomi; 1♀ Russia, Altaj, 40 km E pos.[village] Kosh-Agach, 1.–5.vii.1997 (L'vovskij). 1♀ **Kazakhstan**, okr. Alma-Ata, Namok. uschel'je, v plodah zontichnogo (vyvodka Nr. 613), vii.1938 (Gerasimov). 1♀ **Kyrgyzstan**, Cholpon-Ata, za avtovokzalom na lugu, 6.viii.1987 (L'vovskij & Nikiforova). 1♂ 3♀ Kirgizija, 25 km S Kara-Balta, Sosnovka, 1100 m, 14.viii.1987 (L'vovskij & Nikiforova). 1♀ Kungej-Alatau, 2000 m, 29.vi.2000 (Kljuchko).

Life history. Larvae on *Pimpinella saxifraga* L., *Ferula communis* L., *Laserpitium* sp., on flowers and unripe fruits of *Seseli arenarium* M. B. (Apiaceae). Overwintering as imago (Crimea).

Distribution. Europe from Iberian Peninsula to Poland, Romania, Balkan Peninsula, North Africa, from Turkey to Japan, North America. New records for the faunas of Kyrgyzstan and the Tuva Region.

References. Latvia, South-Western and Southern part of European Russia, Caucasus (Gaedike 1996b: 159; Fal'kovitsh 1981: 434; Savenkov et al. 1996: 25; Jurivete et al. 2000: 58; Shmytova 2001: 90), Western Ukraine (Schille 1930: 226, under the name *E. aequidentella*), East Crimea (Budashkin 1990: 53), Kazahstan, Altaj Mts., South-western and East Siberia, Far East of Russia, Southern Kuril Islands (Kunaschir Island), Magadan region (Gaedike 1993: 98–99; Budashkin 1996: 12; Bidzilja & Budashkin 1997: 81; Budashkin 1997: 483; Bidzilya et al. 2002: 206), Kamchatka Peninsula (Gaedike 1993: 99; Budashkin 1997: 483). Records by Budashkin (1996) were misidentifications of *E. sinjovi*.

Epermenia (*Calotripis*) *petrusella* (Heylaerts, 1883: xi–xii) (*Chauliodus*)

= *Epermenia kroneella* Rebel, 1903
= *Epermenia notodoxa* Gozmany, 1952

Life history. Larvae on *Peucedanum alsaticum* L. and *Peucedanum montanum* (Apiaceae).

Distribution. Only recorded from some parts of Central and Southern Europe.

References. There are only records in the literature from the Kaluzhskaja oblast (Shmytova 2001: 90) and from Western Ukraine (Buszko & Skalski 1980: 17) [without examination this record is doubtful – it may be a misidentification of *E. falciformis*]

Epermenia (*Calotripis*) *falciformis* (Haworth, 1828: 555) (*Recurvaria*)

Material. 1♂ **Russia**, [Ural], Guberli, 23.vi.1892 (Christoph). 2♂ [East Siberia], Irkutsk, without any additional dates; 1♂ Primorskij kraj, 20 km E Ussurijsk, Gornotajozhnoje, na svet, 8.vii.1980 (Omel'ko).

Life history. Larvae on *Angelica sylvestris* (Apiaceae) (Scholz 1996). Tokar et al. (2002: 1–11) indicated *Aegopodium* as food plant, but this record probably refers to *E. illigerella*. The specimen should be re-examined.

Distribution. The species was reestablished as valid by Scholz (1996), it was previously thought to be a synonym of *E. illigerella*. Since this time recorded only from some parts of Middle and North Europe (Scholz 1996; Gaedike 1996b). New record for Russia.

References. Latvia (Jurivete et al. 2000).

Epermenia (*Calotripis*) *illigerella* (Hübner, 1813: pl. 48 fig. 333) (*Tinea*)

Material. 3♂ **Estonia**, 26.vi.1880 (Moravic). 1♀ **Belarus**, okr. Vitebska, d. Tulovo, 10.vi.1995 (Piskunov). 2♂ **Russia**, [Karelija], Jalguba (Günther); 2♂, 1♀ [Karelija], Petrozawodsk (Günther); 2♂ Karel'skij pereshejek, 4., 6.vii.1956 (Kellomjajn); 1♂ Petropol'; 1♀ Petrograd, Ozerki, 13.vii.1917; 1♂, 1♀ Petrograd, Liesnyi, 20.vii.1922; 2♂ Leningradskaja gub., Pavlovsk, 27.vi.1924 (Gerasimov); 1♂ okr. Starogo Petergofa, vyl. 15.vi.1956, N° 10, larvae on *Aegopodium podagraria* (Kuznetsov); 1♂ Leningradskaja obl., Tolmachovo, 9.vi.1960 (Fal'kovitsh); 1♂ Leningradskaja obl., st. Gor'kovskoje, 28.vi.1983 (Sinjov); 2♀ Arhangel'sk, m. Karela, 15.viii.1968, 21.viii.1969 (Zelenova); 1♀ Novgorodskaja obl., Torbino, 22.vi.1917 (Filip'jev); 2♀ okr. Pskova, 7., 9.vi.1907 (Chistovskij); 1♂, 1♀ Urshum, 11.vii.1902, 16.vii.1908 [Krulikovskij]; 4♂, 1♀ [Caucasus], Nal'chik, Malaja Kizilovka, les, 700 m, 13.vi.1986, 18.vi.1987 (Zagulajev); 1♀ [Caucasus], Nal'chik, botsad, na svet, 15.vi.1986 (Zagulajev); 2♂ [Tatarstan], Sarapul, v.1910 [Krulikovskij]; 1♀ Bashkirskij zapovednik, 50 km SE Uzjana, 24.vii.1937 (Filip'jev); 1♀ Novosibirsk, Ob'GES [hydroelectrical power-station at the river OB], na svet, 1.vii.1994 (Ustjuzhanin); 1♂ Kemerovskaja obl., Vaganovo, 22.vi.1955 (Fal'kovitsh); 3♂ Altaj, Kurajskij hrebet u Aktasha, verhov'ja r. Jarly-Jary, 2600 m, gornaja tundra, 6., 7., 13.vii.1974 (Ju. Kostjuk); 1♀ Siberia, Altay Mts., 42 km S Shebalino, 1230 m, 6.vii.1997 (Ustjuzhanin); 1♀ Siberia, Altay Mts., 14 km N Onguday, 1300 m, 15.vii.1997 (Ustjuzhanin).

Life history. Larvae in leaves of *Aegopodium podagraria* (Apiaceae).

Distribution. All Europe, Western Siberia, Altai region.

References. The records from the literature until 1996 need to be checked, as they may refer to *E. falciformis*. Recorded from Estonia, Latvia, Lithuania, and from the European part of Russia (Fal'kovitsh, 1981: 435; Martin, 1991: 35; Ivinskis, 1993: 65; Savenkov et al., 1996: 25; Gaedike, 1996b: 159; Jurivete, 2000: 58; Erschoff, Fil'd, 1870: 187; Kuznetsov & Stekol'nikov 1984: 71; Erschoff 1881: 220; Rebel 1901: 179; Krulikovskij, 1907: 233; Shmytova 2001: 90; Satshkov et al. 1996: 70); Karelia (Gjunther 1896: 32); Belarus (Merzhejevskaja et al. 1976: 19), Western and Northern parts of Ukraine (Schille 1930: 225; Sovyns'kyj 1938: 35); Ural Mts. (Eversmann 1844: 576); Caucasus Mts. (Budashkin 1996: 13); Western Siberia and Altai (Tibatina 1976: 353; Fal'kovitsh 1981: 435; Gaedike 1993: 102; Budashkin 1997: 483). The records from South Ural, East Siberia, and Southern Primorje (Gaedike 1993: 102; Budashkin 1996: 13; 1997: 483) refer to *E. falciformis*.

Epermenia (*Epermenia*)

Epermenia (*Epermenia*) *pontificella* (Hübner, 1796: 56, pl. 26 fig. 181) (*Tinea*)

Material. 1♂ **Ukraine**, Lemberg [= Lwow], Coll. Museum Bucuresti; 1♂, 1♀ Galizien [= Galicia], Krzywcze, p. Borsazczow, 31.v.1937, leg. S. Toll.

Life history. Larvae on *Thesium montanum* (Santalaceae).
Distribution. All Europe, Asia Minor (Turkey).
References. The species was recorded from West Ukraine (Schille 1930: 225), Estonia, Lithuania, and the European part of Russia (Ivinskis 1993: 65; Gaedike 1996b: 159; Jurivete et al. 2000: 58).

Epermenia (*Epermenia*) *scurella* (Stainton, 1851: 25) (*Elachista*)

Life history. Foodplants of the larvae are still unknown.
Distribution. Mountain regions of Central and South Europe.
References. There are only records in the literature from West Ukraine (Carpathian Mountains) (Schille 1930: 225; Falkovitsh 1981: 435).

Epermenia (*Epermenia*) *ochreomaculella ochreomaculella* (Milliere, 1854: 63–64) (*Chauliodus*)

= *Epermenia prohaskaella* Schawerda, 1921.

Material. 2♂ **Russia**, Saratovskaja obl., s. Nizhnjaja Bannovka, 28.vi.2003 (Sinjov); 3♂ Caucasus, Kabardino-Balkarija, s. Planovskoje, 8., 10.vi.1997 (Bolov). 3♂ **Ukraine**, Zaporozhskaja obl., Vol'njanskij r-n, balka Bal'chanskaja, 18., 22., 25.vi.1997 (Zhakov); 5♂, 1♀ Crimea, Krasnoles'je, 29.iv.1983; 4.vii.1984; 7., 8.v., 8., 21.vi.1985 (Zagulajev); 1♂ Crimea, Schastlivoje, kvarc, 3.vii.1984 (Zagulajev); 1♂ Crimea, Aj-Petri, 27.vii.1989 (Budashkin). 1♂ Crimea, s.Osovino, kvarc, 9.vi.1984 (Zagulajev).

Life history. Foodplants of the larvae are still unknown.
Distribution. South Europe from Iberian Peninsula to Bulgaria (New record for the Caucasus area).
References. Western Ukraine (Buszko & Skalski 1980: 17), South-eastern Ukraine (Bidzilja 1995: 35; Bidzilja et al. 2001: 81), Crimea (Budashkin 1990: 53).

Epermenia (*Epermenia*) *ochreomaculella asiatica* Gaedike, 1979: 278

Material. 1♂ **Russia**, [Zabajkal'je], Chitinskaja obl., 20 km N p. Kyra, 6.viii.1994 (Ustjuzhanin). 1♂ Amurskaja obl., 75 km W Svobodnogo, 12.vi.1959 (Fal'kovitsh).

Life history. Foodplants of the larvae are still unknown.
Distribution. From Near East (Lebanon) to Mongolia. New record from the Amur region.
References. Southern part of Siberia (Gaedike 1993: 102); Region Zabajkal'je (Kostjuk et al. 1994: 10; Budashkin & Kostjuk 1994: 17; Budashkin 1997: 483).

Epermenia (*Epermeniola*) Gaedike, 1968: 617

Epermenia (*Epermeniola*) *thailandica* Gaedike, 1987: 155–157

Material. 2♀ **Russia**, [Priamur'je], e.l. [1960] (larvae collected 14., 17.viii.1959) (T. Shel'deshova).

Life history. Larvae in fruits of *Eleutherococcus senticosus* (Araliaceae). The pupa overwinters.
Distribution. Thailand; Russian Far East.
References. Russian Far East (Gaedike 1993: 103–104; Budashkin 1997: 483).

Epermenia (*Cataplectica*) Walsingham, 1894: 199–200

Epermenia (*Cataplectica*) *wockeella* (Staudinger, 1880: 382) (*Chauliodus*)

Material. 1♂ **Turkmenistan**, Central'nyj Kopetdag, Firjuza, 29.–30.iv.1991, na svet (Dubatolov); 1♀ Zapadnyj Kopetdag, niz uschel'ja Aj-dere, na svet, 23.iv.1991(Dubatolov); 1♀ Kopetdag, 20 km E Nohura, uschel'je Karajalchi, 27.iv.1991 (Dubatolov & Zinchenko).

Life history. Foodplants of the larvae still unknown.
Distribution. Hitherto known only from Turkey (type locality) and Turkmenistan. New record for Turkmenistan.
Remarks. The examination of the male of this species confirms that *wockeella* belongs to the genus *Epermenia*. The structure of the male genitalia (narrow tegumen) shows that the species is a member of the subgenus *Cataplectica*. Figures 1–3 show the hitherto unknown male genitalia: Uncus with widened rounded apex, narrower in middle; tegumen narrow, apical edge more thickly sclerotized; valva with broad rectangular transtilla, sacculus with a blunt rounded tooth apically, ampulla curved, pointed, border of valva not clearly visible; phallus as long as valva, slightly curved, with two more sclerotized bands extending from base to distal half, cornutus as long as half of phallus, elongate and apically pointed.

Epermenia (*Cataplectica*) *iniquella* (Wocke, 1867: 208) (*Chauliodus*)

= *Calotrypis dentosella* auct., nec Herrich-Schäffer, 1854
= *Cataplectica kruegeriella* Schawerda, 1921

Material. 8♂, 11♀ **Ukraine**, Crimea, Cape Chauda, solonchakovaja step', na list'jah i cvetah *Ferula caspica*, 1.vi.2002 (Budashkin). 1♀ **Russia**, Caucasus Mts., Teberda, 1250 m, 10.–21.vii.1972 (Eichler). 1♀ **Kazakhstan**, Biesimas, 5 km S Topoljovki, Sardkanskogo r-na, Taldy-Kurganskoj obl., 2.vii.1957 (Kuznetsov). 1♀ **Tajikistan**, [Pamir], Horog, botanicheskij sad, na svet, 31.v.1969 (Martynova).

Life history. Larvae on *Peucedanum officinale* and on *Ferula caspica*.
Distribution. Europe (from Southern France to Greece, Poland, and Ukraine); from Turkey to Iran, Kazakhstan and Tajikistan. New record for Tajikistan.
References. European part of USSR (Gaedike 1996b: 159); Western Ukraine (Schille 1930: 226, under the name *E. dentosella* Herrich-Schäffer), Crimea (Budashkin 1996: 13); Caucasus Mts. (Fal'kovitsh 1981: 434, under the name *E. dentosella* Herrich-Schäffer); Kazakhstan (Gaedike 1993: 103).

Epermenia (*Cataplectica*) *vartianae* (Gaedike, 1971: 43–45) (*Cataplectica*)

Material. 1♂ **Tajikistan**, Kondara, 24.v.1973 (Fal'kovitsh); 1♀ Pamir, Horog, 2300 m, na kvarc, 22.vi.1965 (Gur'jeva); 1♂ 30 km N Duschanbe, Kondara, 4.vii.1986 (Puplesis).

Life history. Foodplants of the larvae are still unknown.
Distribution. SE Afghanistan (Safed Koh) (type locality), Tajikistan. New record for Tajikistan.
Remarks. The material from Tajikistan allows the description of the hitherto unknown female genitalia of this species (Fig. 4). Apical edge of last sternite more strongly sclerotized than rest of sternite; shorter part of forked apophyses very thin. Corpus bursae without signum.

Epermenia (*Cataplectica*) *farreni* (Walsingham, 1894: 200–201) (*Cataplectica*)

Material. 1♂, 1♀ **Russia**, Polar Ural, 66°55'N, 65°10'E, Krasnyj Kamen', 200 m, 7.vii.1994 (Jalava, Kullberg & Koponen). **Kazakhstan**: 1♀ Zailijskij Alatau, Medeo, 25.viii.1986 (Mironov). 2♀ **Kyrgyzstan**, 14 km E g. Naryn, hr. Karyktau, 2700 m, 4.viii.1988 (Mironov).

Life history. Larvae in seeds of *Peucedanum montanum*.
Distribution. Only recorded from some European countries (Great Britain, Sweden, Slovakia, Northern Russia); Kazakhstan, Kyrgyzstan. New records for Kazakhstan, Kyrgyzstan, and Russia.

Epermenia (*Cataplectica*) *profugella* (Stainton, 1856: 38–39) (*Asychna*)

Life history. Larvae in seeds of *Pimpinella saxifraga* and other species of this genus.
Distribution. North, Central, and East Europe.
References. Estonia, Latvia, European part of Russia (A. & I. Sulcs 1987; Ivinskis 1993: 65; Savenkov et al. 1996: 25; Gaedike 1996b: 159; Jurivete et al. 2000: 58), West Ukraine (Schille 1930: 230).

Epermenia (*Cataplectica*) *sergei* Budashkin, 1996: 13–15, figs. 1–2

= *Epermenia sergeyi* Budashkin, 1997 (lapsus calami)

Life history. Foodplants of the larvae are still unknown.
Distribution. Hitherto known only from the locality of the typical series: Russian Far East: Priamur'je and Primor'je (Budashkin 1996: 13–15; Budashkin 1997: 483 under the name *E. sergeyi* Budashkin). In the literature (Gaedike 1993: 92) the species was recorded erroneously as *Phaulernis dentella* Zeller.

Ochromolopinae

Ochromolopis Hübner, 1825: 408

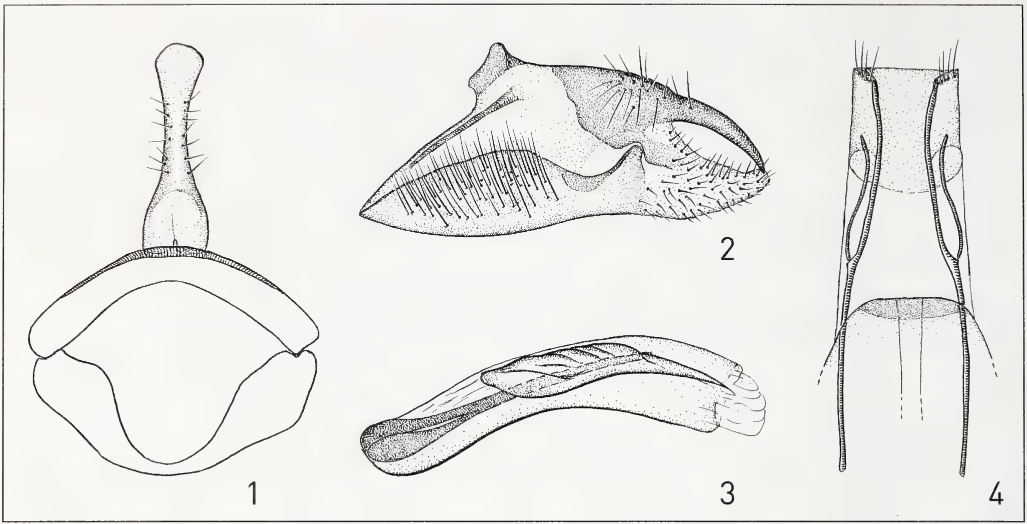
Type species: *Ochromolopis ictella* Hübner, 1813, designated by Herrich-Schäffer, 1854: 213

Ochromolopis ictella (Hübner, 1813: pl. 53 fig. 361)

= *Ornix ictipennella* Treitschke, 1833

Material. 1♂ **Ukraine**, Ubierzowa, p. Zaleszyki, 18.v.1936 (Toll).

Life history. Larvae are miners in *Thesium* spp. (Santalaceae).
Distribution. Central and South Europe, North Africa.
References. Estonia (Jurivete et al. 2000: 58), Belarus (Merzhejevskaja et al. 1976: 19), Western, Central, and Northern part of Ukraine, Caucasus Mts.* (Schille 1930: 232; Lebedev 1936: 64; Obraztsov 1936: 32); Sovyns'kyj, 1938: 85; Fal'kovitsh 1981: 445), Southern part of European Russia* (Gerasimov 1948: 976), probably in the west of European Russia (Budashkin & Satshkov 1991: 83), European Russia* (Gaedike 1996b: 159).
The records marked with an asterisk need revision because they may refer to *O. zagulajevi*. Other hitherto published records from Asia Minor and Near East need further examination because they may refer to *O. zagulajevi* also.



Figs. 1–4. *Epermenia (Cataplectica) wockeella.* **1.** ♂, Uncus-tegumen-vinculum complex. **2.** ♂, valva. **3.** ♂, phallus. **4.** ♀, *Epermenia (Cataplectica) vartianae.*

Ochromolopis zagulajevi Budashkin & Satshkov, 1991: 78–81, figs. 1–2

Material. 1♂ **Russia**, Saratovskaja obl., s. Nizhnjaja Bannovka, 28.vi.2003 (Sinjov).; 10♂, 2♀ Caucasus, 43'N, 43'E, Kabardino-Balkarskij zap., 35 km SE Elbrus, 2300 m, 9., 10., 11., 12., 13.vii.1990 (Jalava). 1♀ **Ukraine**, Zaporozhskaja obl., Vol'njanskij r-n, balka Bal'chanskaja, 25.vi.1997 (Zhakov). 1♀ **Moldova**, Kishinjov, na svet, 2.vi.1981 (Belousov). 1♂ **Georgia**, Umg. Tbilissi, 500–600 m, 30.5.–1.vi.1971 (Muche). 1♂ **Armenia**, Geghard, 1700 m, 40 km E Erevan, 26.–27.vii.1976 (Kasy & Vartian).

Life history. Foodplants of the larvae are still unknown.

Distribution. See below. New record for Moldova.

References. Middle part of Povolzh'je, Northern Part of Ukraine, Crimea, Caucasus Mts., Transcaucasus, Western Kazakhstan (Budashkin & Satshkov 1991: 78–81, 83: typical series); European part of Russia (Gaedike 1996b: 159); Middle part of Povolzh'je (Satshkov et al. 1996: 70); South-East of Ukraine (Bidzilja et al. 2001: 81); South-East Crimea (Reservat Karadag) (Budashkin 1990: 53, under the name *O. ? ictella* Hübner).

Ochromolopis kaszabi Gaedike, 1973: 96–97, figs. 1–4

Material. 6♂ **Russia**, SW-Altai, Kuragan valley, 15 km S Katanda, 1200 m, 23.–25.vii.1983, (Exp. Mikkola; Hippa & Jalava); 1♀ Burjatskaja ASSR, Ulan-Udenskij r-n, p. Kalenovo, na svet, 2.viii.1985 (Ustjuzhanin); 1♂ [Priamur'je], Klimoucy, 16.vi.1959 (Fal'kovitsh?); 1♂ Ju. Primor'je, Gornotajozhnoje, 20 km E Ussurijska, na svet, 25.vii.1999 (Sinjov).

Life history. Foodplants of the larvae are still unknown.

Distribution. Mongolia, Russian Far East, Siberia (Southern part).

References. Southern part of Siberia, Far East (Kuznetsov & Stekol'nikov 1984: 73; Budashkin & Satshkov 1991: 81–82; Gaedike 1993: 104; Kostjuk et al. 1994: 10; Budashkin & Kostjuk 1994: 17; Budashkin 1997: 487; Bidzilya et al. 2002: 206). In the Southern Primorje represented by a smaller subspecies *O. kaszabi minima* Budashkin & Satshkov (Budashkin & Satshkov 1991: 82).

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A review of *Dibrachia* Sinev & Sruoga, 1992, a subgenus of *Elachista* (Elachistidae: Elachistinae)

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Abstract. The systematic position of the *Elachista* subgenus *Dibrachia* Sinev & Sruoga, 1992 is revised on the basis of a novel anatomical interpretation of the male juxta-valval process complex in the constituent species. The taxonomy of the species is outlined and new distributional data are presented. Five species are recognised, the following two of which are described as new: *Elachista alicanta* sp. n. (Spain) and *Elachista elksourensis* sp. n. (Tunisia). A redescription and diagnosis are given for all included species.

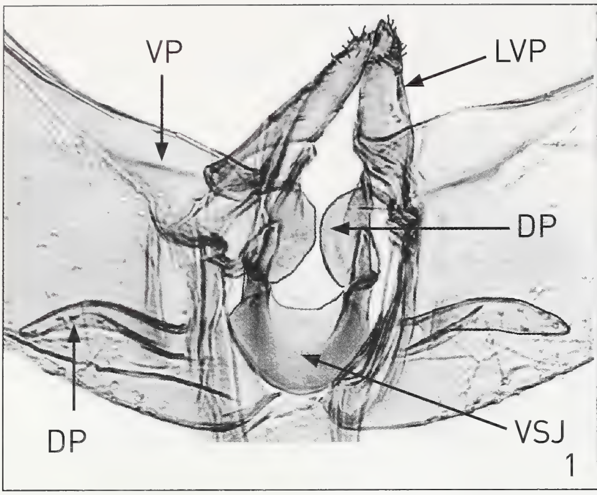
Key words. Elachistidae, Elachistinae, *Elachista*, *Dibrachia*, systematics, genital morphology, juxta-valval process complex, new species

Introduction

The *Elachista* subgenus *Dibrachia* Sinev & Sruoga, 1992 (Elachistidae: Elachistinae) is a small and structurally uniform group of Elachistinae moths distributed in the Palaearctic area. They are confined to xerothermic habitats and their known diversity is highest in the Mediterranean area. The present knowledge of their sites of occurrence indicates that they seem to occur in limestone areas in particular. The immature stages are not known for any of the species. The representatives of subgenus *Dibrachia* are characterised by their peculiarly shaped male genitalia with reduced uncus, uniquely developed and paired comb-shaped gnathos, and broad valvae. Externally, the three previously recognised species are unicolorously white, thus resembling some representatives of *Elachista* subgenus *Aphelosetia* Stephens, 1834. Examination of extensive unidentified samples of Elachistinae has revealed the existence of two new species attributable to subgenus *Dibrachia*.

The three previously recognised species, originally placed in *Elachista* (Chrétien 1908; Parenti 1978; Traugott-Olsen 1990), were transferred to their own genus (*Dibrachia*) owing to their peculiar genital features by Sinev & Sruoga (1992). Kaila (1999) shifted the rank of *Dibrachia* to that of a subgenus of *Elachista* on the basis of a phylogenetic analysis of the subfamily. In this analysis *Dibrachia* came up as the sister group of the clade containing *Elachista* subgenera *Hemiprosopa* Braun, 1948 and *Aphelosetia*.

A detailed scrutiny on the genital morphology of all five species led me to re-consider the anatomic interpretation of the juxta-valval process complex in *Dibrachia*. These species appear to share characteristics that are different from those of all other *Elachista* species. These structures had seemingly passed unnoticed by Parenti (1972), Kaila (1999), and partly also by Sinev & Sruoga (1992), all of whom had predominantly studied *E. kalki* Parenti, 1978, in which these structures are more like those of the 'usual' *Elachista* type. These structures had also partly been incorrectly interpreted by Traugott-Olsen (1990) in the description of *Elachista anatoliensis* (for details, see *Remarks* under the redescription of *E. anatoliensis*). In this paper the male juxta-valval



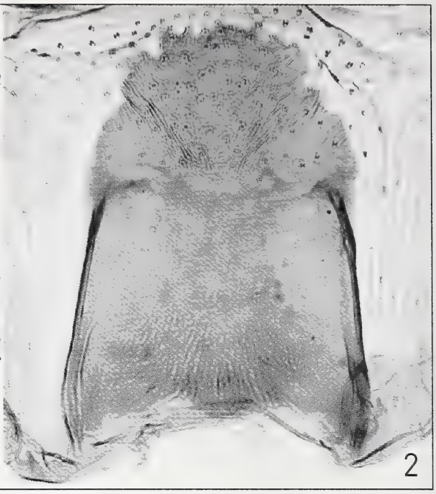


Fig. 1. The juxta – valval process complex of *Elachista* (*Dibrachia*) *alicanta* sp. n. with explanations of anatomic structures. DP digitate process; JL juxta lobes; LVP lobe of valval process; VP valval process; VSJ ventral shield of juxta.
Fig. 2. Sternum II of *Elachista kalki* (L. Kaila prep. n. 4258).

process complex of *Dibrachia* is described in detail and its significance regarding the phylogenetic position of *Dibrachia* is evaluated. The two new species are described and the three previously recognised species are redescribed.

Material and methods

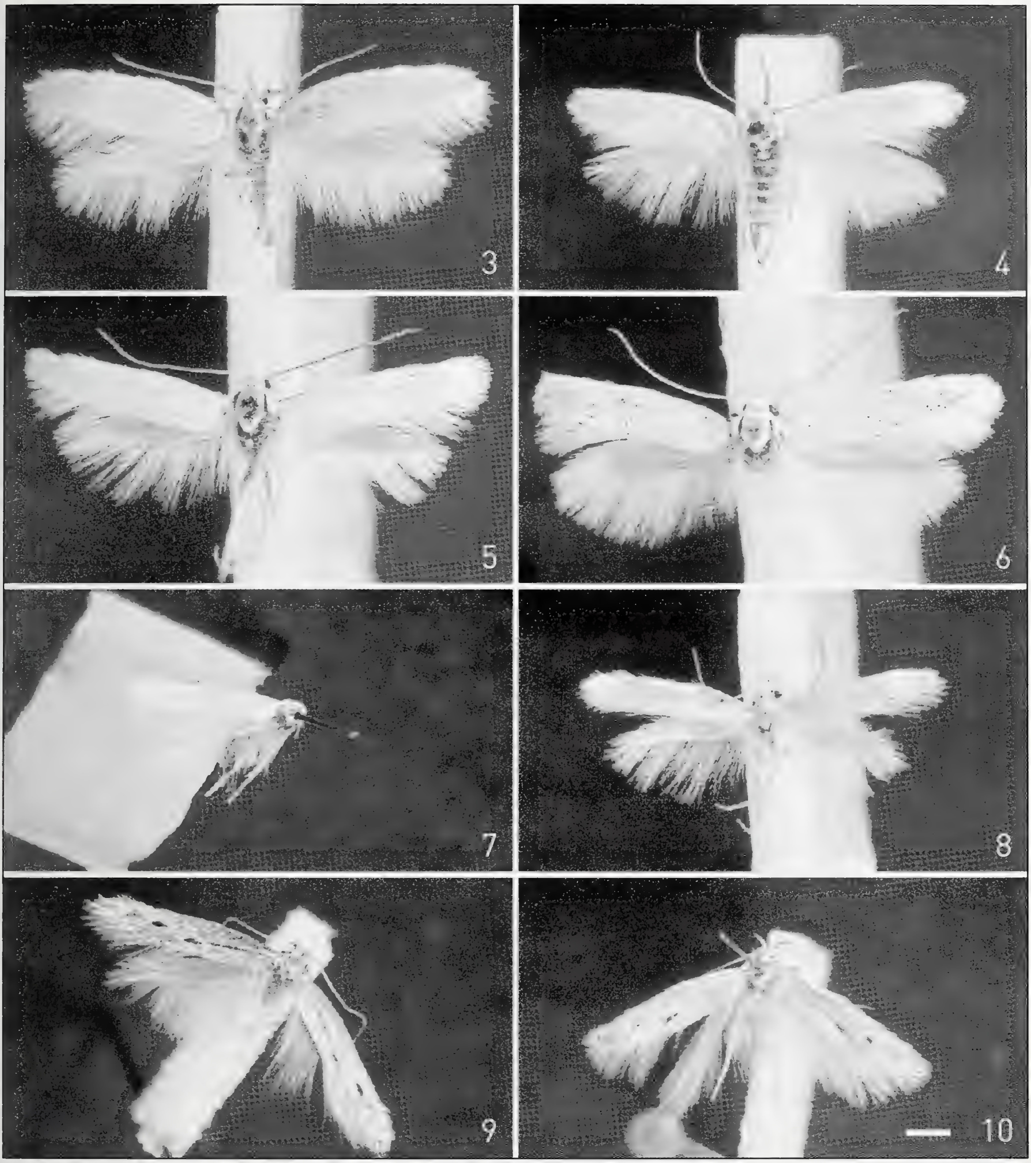
The terminology for morphological structures follows Traugott-Olsen & Schmidt Nielsen (1977) and Kaila (1999). The forewing length was measured from the base of the wing to the end of the fringe. Apart from the material studied for the present study, the described distribution of the included species over European countries follows Kaila (2004b). This paper is based on material obtained from the following collections:

TLMF	Tiroler Landesmuseum Ferdinandeum, Innsbruck, Austria (P. Huemer).
MZH	Zoological Museum, Finnish Museum of Natural History, University of Helsinki, Finland (L. Kaila).
SZMN	Siberian Zoological Museum, University of Novosibirsk, Russia (V. V. Dubatolov).
ZMUC	Zoological Museum, University of Copenhagen, Denmark (O. Karsholt).

Private collections of following persons: Jari Junnilainen (Vantaa, Finland), Jari Kaitila (Vantaa, Finland), Kari and Timo Nupponen (Espoo, Finland), Zdeno Tokár (Michalovce, Slovak Republic), and Vadim Zolotuhin (Ul'yanovsk, Russia).

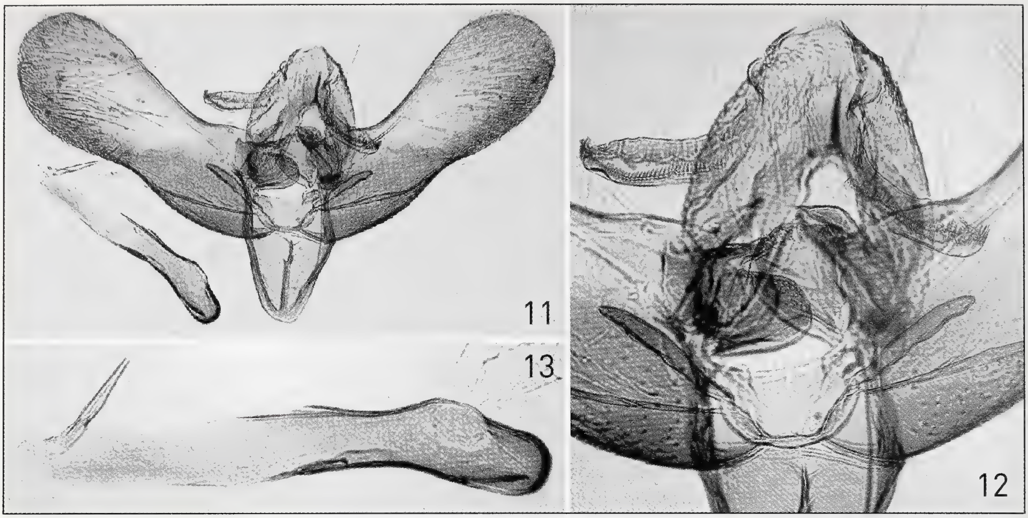
Systematic position of *Elachista* subgenus *Dibrachia*

In *Dibrachia kalki* the juxta lobes are bilobed and setose (cf. Parenti 1978: pl. 2; Figs. 12, 14). In other species of *Dibrachia* the lobes are entirely separate from each other, the 'real' juxta lobes are unsetose, and the other lobe is triangular or tongue-shaped



Figs. 3–10. Habiti of *Elachista* spp., scale 1 mm. **3.** *E. kalki* Parenti ♂ (Russia, S. Urals). **4.** *E. kalki* Parenti ♀ (Russia, S. Urals). **5.** *E. totalbella* Chrétien ♂ (Tunisia). **6.** *E. elksourensis* sp. n. ♂ holotype (Tunisia). **7.** *E. anatoliensis* Traugott-Olsen ♂ holotype (Turkey). **8.** *E. anatoliensis* Traugott-Olsen ♂ (Ürgüp, Turkey). **9.** *E. alicanta* sp. n. ♂ holotype (Spain). **10.** *E. alicanta* sp. n. ♀ paratype (Spain).

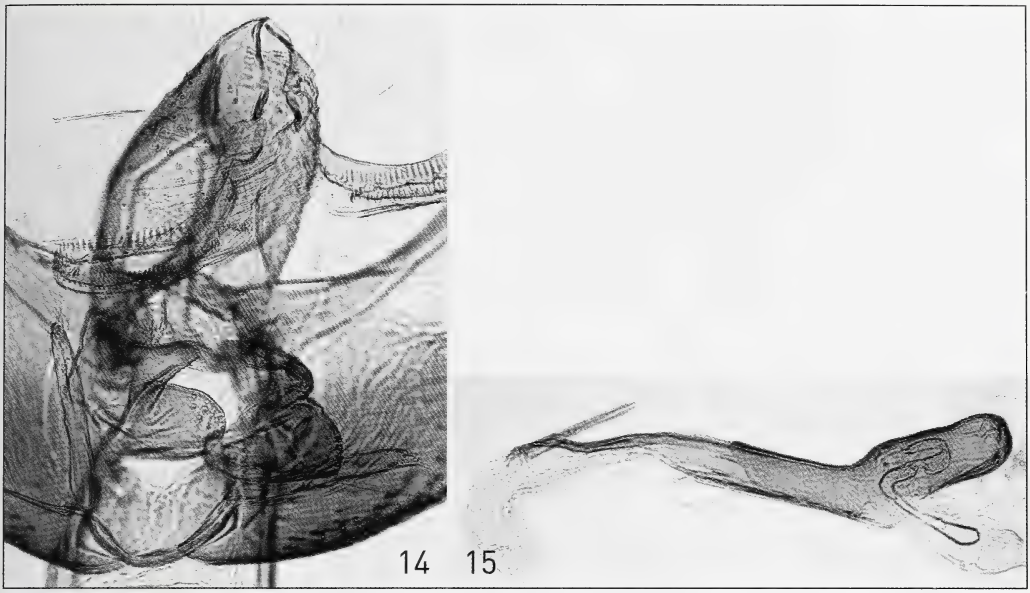
and apically setose (see Fig. 1 for explanations). This structure is similar to Kaila's (1999) character 51: 1 (valval process present as membranous connection between ventral surface of valva and juxta lobe that bears a tongue-shaped lobe medially). This characteristic was found to be a unique synapomorphy for the genus *Stephensia* Stainton, 1858 (Kaila 1999). It is not possible to evaluate whether the structure here called as the lobe of the valval process is really a derivative of the valval process



Figs. 11–13. Male genitalia of *Elachista kalki* (Greece, L. Kaila prep. n. 4013). **11.** General view. **12.** Details of uncus, gnathos, and juxta. **13.** Phallus.

or the juxta, and the terminological convention used here follows Kaila (1999). The ventral shield of the juxta of *Dibrachia* is typically sickle-shaped or semicircular with dorsolaterally directed extensions. The juxta lobes are connected to the ventral shield by a narrow joint. These characteristics appear unique to *Dibrachia*. Unlike other *Elachista*, the median plate of the juxta is simple, without folded margins, a condition that is primitive in the phylogenetic framework of Kaila (1999). The valval process is nearly membranous in *E. kalki*, but to some extent sclerotised in the other species of the subgenus *Dibrachia*.

Since the publication of the phylogenetic analysis of the Elachistinae by Kaila (1999) the data matrix has been updated by Kaila & Sugisima (2003, and unpublished data). This updating not only includes new outgroup taxa in accordance with Kaila (2004a), but also 35 additional ingroup taxa, many new characters, and a revision of some codings and character state definitions. The revised data matrix will be published in another context (Kaila & Sugisima, in preparation). A preliminary re-analysis of the revised data matrix in its present, yet incomplete form, with novel and revised findings regarding *Dibrachia* incorporated, was executed for evaluating the position of *Dibrachia*. The outcome (not shown) indicates that the monophyletic *Dibrachia* may be the basal lineage of *Elachista*. It would also indicate that the lobe of the valval process is of independent origin in *Stephensia* and *Dibrachia*, respectively. The position of *Dibrachia* indicates that the originally weakly supported monophyly of the clade containing subgenera *Dibrachia*, *Hemiprosopa* and *Aphelosetia* (Kaila 1999) would be broken. This position could allow the recognition of *Dibrachia* again as a genus, following Sinev & Sruoga (1992). However, such a change is not suggested here for the following reasons. Firstly, this result is based on a preliminary analysis of an incomplete data set. Secondly, the immature stages of *Dibrachia* and *Hemiprosopa* still remain unknown, a situation which unavoidably hampers our understanding of the position of these groups. Thirdly, the monophyly of *Elachista* s. l. seems much



Figs. 14–15. Male genitalia of *Elachista kalki* (Russia, Urals). **14.** Details of uncus, gnathos and juxta (L. Kaila prep. n. 4257). **15.** Phallus (L. Kaila prep. n. 4258).

better supported than the interrelationships of the constituent subgenera. This finding indicates that further modifications to the data matrix could easily again change their position, while the monophyly of *Elachista* s. l. is less likely challenged. Therefore, the nomenclatorial stability is better maintained if no changes are now made.

Diagnosis of *Elachista* subgenus *Dibrachia*

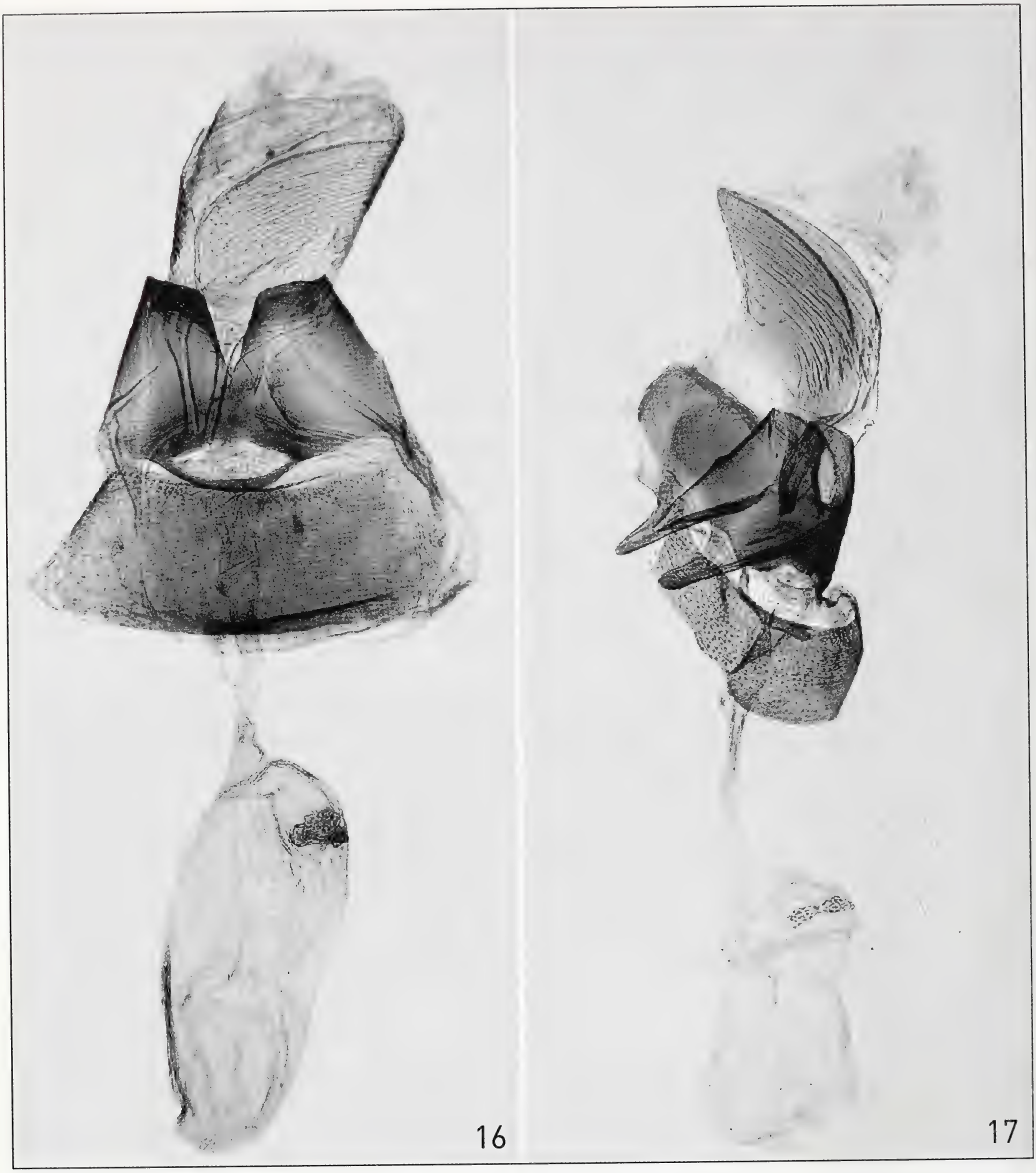
Notes on the distribution of some characters within Elachistinae are mentioned within brackets [].

Head. Smooth-scaled, neck tuft weakly raised. Tongue basally scaled, length less than diameter of head. Maxillary palpi vestigial, 2-segmented. Lateral external ocelli absent. Antenna extended to about 2/3 of forewing, scape basally with pecten consisting of numerous elongate, stiff hair-like scales; flagellum without visible ciliation. Length of labial palpus 0.8–1.5 times diameter of head.

Thorax. Forewing acute; five costally directed R-veins present; M1 stalked with R; M2 free, from end of cell; CuA1 and CuA2 present. Hindwing lanceolate, cell open; M2, CuA1 and CuA2 on common stalk. Tarsal articles with three stout spines distally, spines sometimes also present on ventral surface of tarsal articles of mid- and hindleg.

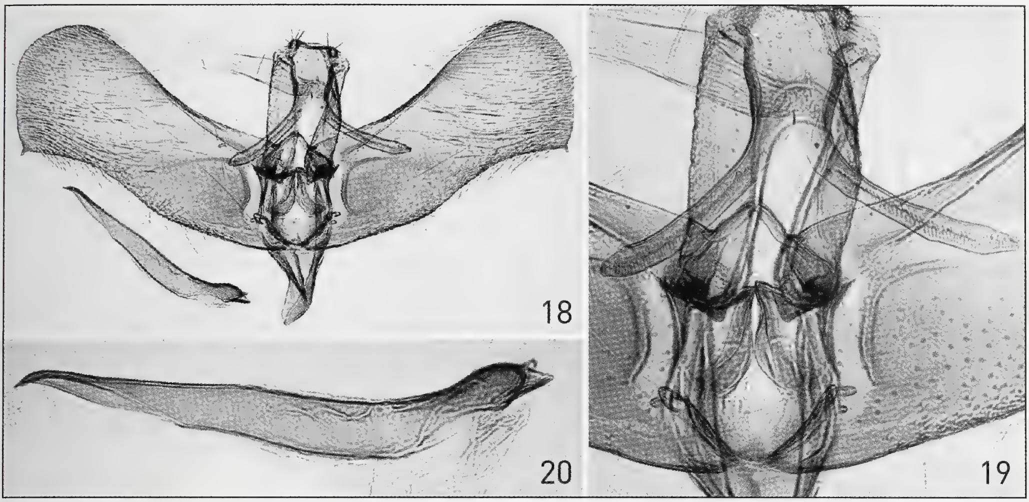
Pregenital abdomen. Sternum 2 with long and narrow, well distinguished sternal rods [also in *Stephensia* and some species in *Elachista* subgenus *Aphelosetia*], without apodemes (Fig. 2). Anterior margin of male tergum 8 sclerotised, without further modifications.

Male genitalia. Uncus lobes vestigial, present at most as low triangular, setose swellings. Socius present as a small group of small setae. Basal arms of gnathos fused medially; lobes of spinose knob of gnathos separate, elongate, tongue-shaped, with



Figs. 16–17. Female genitalia of *Elachista kalki*. **16.** L. Kaila prep. n. 4261 (Russia, Ul'yanovsk). **17.** L. Kaila prep. n. 4260 (Russia, Tuva).

comb-like longitudinal double row of spines. Without sclerotised anellus. Transtilla made of medially projected hook-like appendices of valval costa. Valva with more or less sclerotised valval process on ventral surface; also with tongue-shaped or triangular setose lobe between juxta lobe and valval process [also in *Stephensia*]. Costa unfolded [usually in *Elachista* the costal sclerotisation forms distinctive basal and distal folds]. Cucullus expanded, rounded, often with small spine at end of indistinct sacculus. Median plate of juxta sickle-shaped or oval, without lateral foldings, dorsolaterally extended



Figs. 18–20. Male genitalia of *Elachista totalbella* Chrétien (Tunisia, L. Kaila prep. n. 4142). **18.** General view. **19.** Details of uncus, gnathos and juxta. **20.** Phallus.

to give lateral support for phallus, without median or lateral pockets. Juxta lobes of variable shape, widely placed apart from each other, narrowly connected to median plate of juxta, distinctly sclerotised, ventral surface distally with or without group of setae. Dorsal shield of juxta absent. Elongate tongue-like, setose digitate process between median plate of juxta and ventral surface of valva present and fully developed, vestigial, or absent. Phallus not ankylosed, with or without manica; sometimes with cornuti.

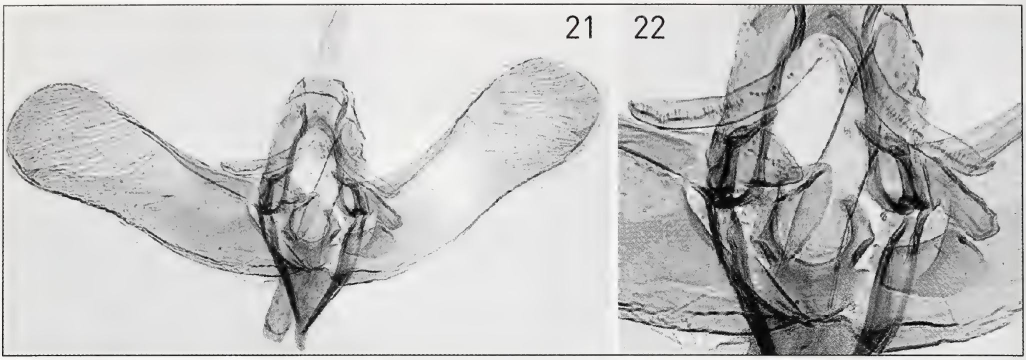
Female genitalia. Papillae anales sclerotised, dorsodistally fused, forming a sharp blade [papillae anales similarly dorsodistally fused in *Perittia* and *Elachista dissona* Kaila], sparsely covered by sensilla; lacking microtrichiae [microtrichiae absent also in *Perittia*, *Urodeta*, and *Elachista dissona* Kaila]. Posterior margin of sternum 8 reinforced, with deep mesal incision. Ostium bursae situated on sternum 8. No antrum present; ductus seminalis membranous, tubular, incepted to ductus bursae cephalad of colliculum; ductus bursae tubular, straight; corpus bursae with internally directed spiculae; with one dentate signum of variable shape.

The species of *Elachista* subgenus *Dibrachia*

Elachista kalki Parenti, 1978 (Figs. 2–4, 11–17)

Elachista kalki Parenti, 1978: 20, pl. 2.
Dibrachia kalki (Parenti, 1978); Sinev and Sruoga 1992: 154.
Elachista (*Dibrachia*) *kalki* Parenti, 1978; Kaila 1999: 164.

Material. 1♂, 1♀ **Germany**, Kyffhäuser, Kosacken Berg 27.v.1939, Jäckh leg. (ZMUC). 1♂ **Greece**, 15 km W Konsani 16.v.1997, Selling leg. (Kaila prep. n. 4283) (ZMUC); 1♂, 1♀ Makedonia, 35 km S Grevena 24.v.2001, leg. et coll. Junnilainen (L. Kaila prep. n. 4013 ♂). 1♂ **Hungary,** Örkény 2.-3.v.2003 Richter leg., (coll. Tokár). 6♂ 2♀ **Russia**, S. Ural, Cheliabinsk oblast, 52°39'N 59°34'E, 350 m, Arkaim reserve near Amurskii village, 18.–19.v.2004, Nupponen leg. (coll. Nupponen & MZH); 6♂

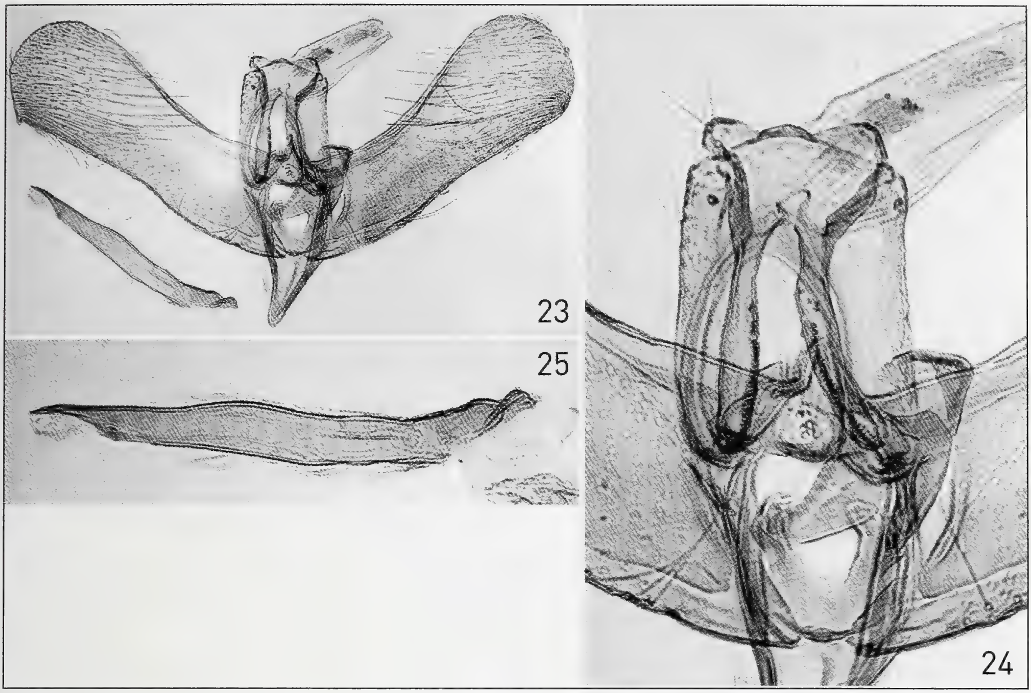


Figs. 21–22. Male genitalia of the holotype of *Elachista anatoliensis* Traugott-Olsen (ETO C.3.12.89). **21.** General view. **22.** Details of gnathos, and juxta.

Cheliabinsk oblast, 52°39'N 59°00'E, 300 m, 15 km S. Kizilskoye, near Ural river, 27.v.1998, Junnilainen leg., 30♂ same data, T. & K. Nupponen leg. (coll. Junnilainen, Nupponen, MZH); 1♂ Cheliabinsk oblast, 53°57'N 59°03'E, 650 m, near Moskovo village, 26.v.1998, Junnilainen leg. (coll. Junnilainen); 13♂ Orenburg oblast, 51°13'N 57°37'E, 350 m, 20 km S Mednogorsk, near Kidriasovo village 28.–29.v.1998, Junnilainen leg. (coll. Junnilainen); 2♂ same, T. & K. Nupponen leg. (coll. Nupponen); 3♂ Orenburg oblast, 51°23'N 56°49'E, 130–340 m, 6 km W. Donskoje village, Mount Verbljushka, 13.v.1999, Nupponen leg. (coll. Nupponen); 1♂ Cheliabinsk oblast, 53°59'N 61°12'E, 250 m, Troizkii reserve near Berlin village, 30.vi.1997, Nupponen & J. Junnilainen leg. (coll. Junnilainen, Nupponen); 6♂ 2♀ Orenburg distr. Arkaim near Amurskii village 18.–19.v.2004, Nupponen leg. (coll. Nupponen), 1♂, 1♀ in MZH); 3♂ 1♀ Ul'yanovsk obl., Akulovka, Nikolaevka distr. 150 km SWS Ul'yanovsk, limestone steppe, 53°06'N 47°29'E 16.v.1998, Zolotuhin leg.; 2♂ Vjazovka, 6 km S., Radishchevo distr., 166 km S Ul'yanovsk, 52°51'N 48°21'E, 6.–9.v.2000, Zolotuhin leg.; 1♂ Radishchevo distr., 160 km S Ul'yanovsk, 52°53'N 48°26'E 2.vi.1993, Zolotuhin leg.; 1♂, same data, 24.v.1994, Isajeva leg.; 1♂ Vjazovka, 8 km S., Radishchevo distr., 168 km S Ul'yanovsk, 52°50'N 48°18'E, 4.v.2002, Isajeva leg. (Specimens from Ul'yanovsk in coll. Zolotuhin and in MZH); 3♂ 3♀ Tuva rep. 50°16'N 94°54'E, 1250 m, 25 km W. Erzin, steppe/stony slopes, 7.–11.vi.1995, Jalava & Kullberg leg. (MZH).

Diagnosis. *Elachista kalki* is the most broad-winged of the *Dibrachia* species (Figs. 3–4), and its labial palpi are shorter than in the other species, at most as long as the diameter of the head. Its forewings are shiny white; the sheen distinguishes it from nearly all other white *Elachista* species, except *E. galacticella* Eversmann of subgenus *Aphelosetia*. These species are externally readily identifiable by the presence of the uncus in the male of *E. galacticella*, which can be seen without brushing the abdomen. The females of these species are identified by the blackish blade-shaped papillae anales of *E. kalki*, also visible without brushing. The male genitalia of *E. kalki* differ from those of other *Dibrachia* species by the very vestigial unsetose uncus, the valva without any distal spine on the cucullus, the setose juxta lobes, and the long straight cornutus on the vesica (Figs. 11–15).

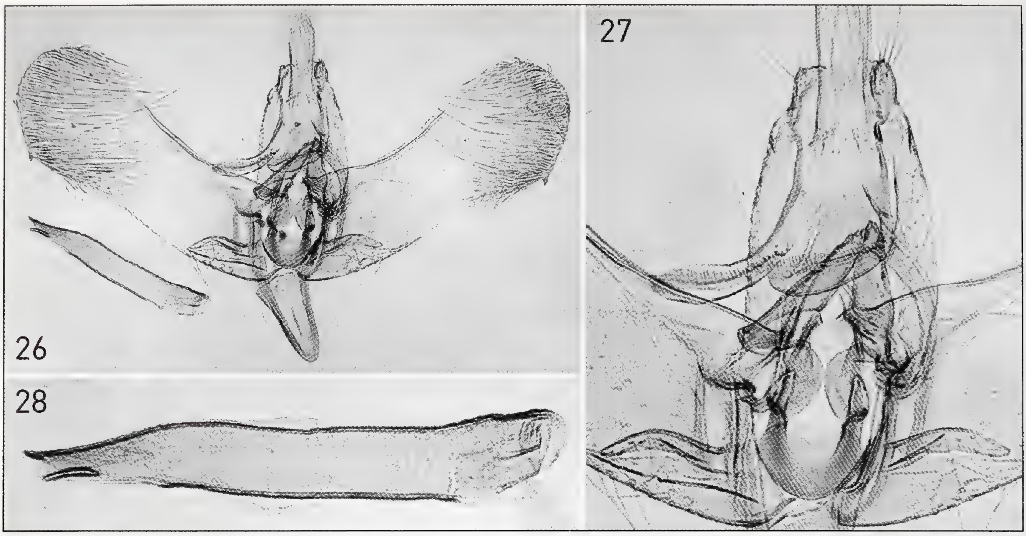
Description. Forewing length of ♂ 4.8–5.5 mm, ♀ 4.8–5.2 mm. Length of labial palpus 0.8–1.0 times diameter of head, almost straight, greyish white. Scape dense, white, pecten white, pedicel and flagellum grey. Head varying from grey to pale ochreous. Neck tuft, patagia, and thorax greyish white. Whole antenna concolorous with head. Abdominal segments basally shiny light grey, distally white. Fore- and midleg inwardly pale, outwardly pale or leaden grey, hindleg ochreous white. Forewing broad, unicolorous shiny white except basal 1/5 of costa narrowly dark grey; fringe concolorous. Hindwing pale grey, translucent; fringe white. Underside of fore- and hindwings grey, fringe white.



Figs. 23–25. Male genitalia of *Elachista anatoliensis* (Turkey, Ürgüp, L. Kaila prep. n. 3909). **23.** General view. **24.** Details of uncus, gnathos, and juxta. **25**. Phallus.

Male genitalia. Uncus lobes vestigial. Lobes of the spinose knob of gnathos separate, tongue-shaped, with comb-like longitudinal double row of spines, length 1/4 length of valva. Valva narrowest medially, three times longer than wide at narrowest point, with somewhat sclerotised valval process on ventral surface; costal sclerotisation unfolded; sacculus basally somewhat swollen, s-shaped, without distal spine, cucullus expanded, rounded. Ventral shield of juxta semicircular, dorsolaterally extended; juxta lobes widely set apart from each other, narrowly connected to median plate of juxta, broad, cusp-like, distally setose; triangular setose lobe present between juxta lobe and valval process. Digitate process narrow, straight, setose, 1/5 length of valva. Vinculum u-shaped, with distinctive median ridge. Phallus 2/3 length of valva, basally bent, distally tapered to blunt dorsal lobe; blunt caecum with or without small manica; vesica with straight prominent cornutus.

Female genitalia. Papillae anales sclerotised, dorsodistally fused, forming a sharp blade, longitudinally wrinkled, sparsely covered by sensilla, lacking microtrichiae. Apophyses posteriores short, broad; apophyses anteriores very short, triangular. Posterior margin of sternum 8 reinforced, with narrow v-shaped median incision. Ostium bursae on anterior margin of sternum 8, surrounded by strong sclerotised ring. No antrum present; ductus seminalis membranous, tubular, incepted to ductus bursae cephalad of colliculum at posterior 1/3 length of ductus bursae; ductus bursae tubular, straight, as long as corpus bursae; corpus bursae with internally directed spiculae; with one dentate signum of variable shape.



Figs. 26–28. Male genitalia of the holotype of *Elachista alicanta* sp. n. (L. Kaila prep. n. 4193). **26.** General view. **27.** Details of uncus, gnathos, and juxta. 28. Phallus.

Life history. Adults have been collected at light on steppe slopes usually rich in limestone.

Distribution. Austria, Germany, Greece, Hungary, Italy, Kazakhstan (Sinev & Sruoga 1992), Russia (southern Urals, Volga region, Tuva Republic).

Remarks. New to Greece.

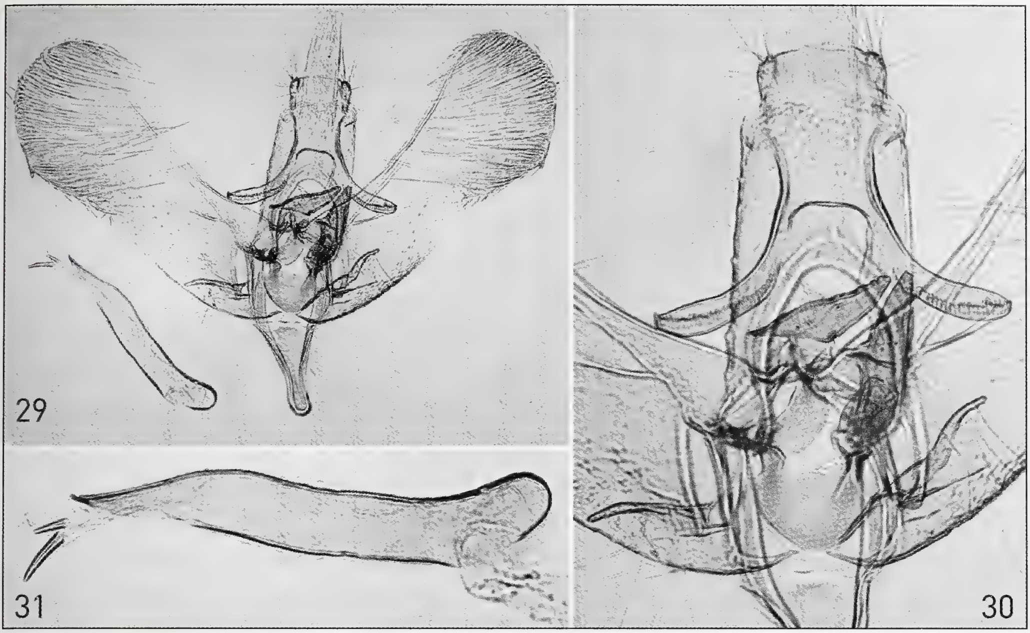
Elachista totalbella Chrétien, 1908 (Figs. 5, 18–20)

Elachista totalbella Chrétien, 1908: 203; Parenti 1972: 30, pl. 1 figs. A–D.
Dibrachia totalbella (Chrétien, 1908); Sinev and Sruoga 1992: 155.
Elachista (*Dibrachia*) *Dibrachia totalbella* Chrétien, 1908; Kaila 1999: 164.

Material. 1♂ **Tunisia**, Atlas Mts., Le Kef, chalk slope, 3.v.2000, leg. et coll. Nupponen.

Diagnosis. *Elachista totalbella* is a rather large unicolorous white species that can be identified most easily from the other *Dibrachia* species by its digitate process of male genitalia in the form of a small setose lobe (Fig. 19).

Description, ♂. Forewing length 5.2 mm. Length of labial palpus 1.3 times diameter of head, white, second segment slightly ochreous below. Head neck tuft, patagia, and thorax white. Scape dense, white, pecten white, pedicel and flagellum grey. Abdominal segments basally shiny light grey, distally white. Foreleg inwardly pale, outwardly mottled grey, mid- and hindleg ochreous white, tibia and tarsal articles outwards mottled grey, distally white. Forewing white except basal 1/5 costa narrowly dark grey, fringe concolorous. Hindwing dark grey, fringe white. Underside of forewing dark grey, fringe white; underside of hindwing dark grey on costal half and along Cu-vein, whitish on tornal half.



Figs. 29–31. Male genitalia of the paratype of *Elachista alicanta* sp. n. (L. Kaila prep. n. 4216). **29.** General view. **30.** Details of uncus, gnathos, and juxta. **31.** Phallus.

Male genitalia. Uncus lobes low triangular, setose. Lobes of spinose knob of gnathos separate, narrow, elongate, with comb-like longitudinal double row of spines, 1/3 length of valva. Valva narrowest medially, three times longer than wide at narrowest point, with somewhat sclerotised valval process on ventral surface; costal sclerotisation not folded; sacculus s-shaped, with small spine apically, cucullus expanded, rounded. Ventral shield of juxta sickle-shaped, dorsolaterally extended; juxta lobes widely set apart from each other, narrowly connected to median plate of juxta, distinctly sclerotised, without setae; triangular setose lobe present between juxta lobe and valval process. Digitate process vestigial, setose, accompanied [or flanked, surrounded?] by additional minute lobes (in studied specimen) that seem absent on lectotype. Vinculum narrow, u-shaped, with distinctive median ridge. Phallus 3/4 length of valva, basally bent, distally tapered to pointed, inwardly-curved apex; blunt caecum with bilobed manica; without cornutus.

Female. Unknown.

Life history. The specimen from Tunisia was collected with a light trap on a xerothermic limestone mountain (K. Nupponen, personal communication).

Distribution. Algeria, Tunisia.

Remarks. The genitalia of the lectotype male as well as those of a paralectotype female were illustrated by Parenti (1972). The male genitalia photos of Parenti (1972: figs. 1A–D) enable unambiguous identification. Therefore, the lectotype was not examined again in the present study. The characteristics of the female specimen illustrated by Parenti (1972: figs. 10A–C, E) disagree with those of the two other *Elachista* (*Dibrachia*) species for which the female is known, i.e. *E. kalki* and *E. alicanta*. In particular, the basally bulbous, unsclerotised papillae anales are quite different in shape, resembling those found in the *Elachista dispunctella* complex. On picture 10: A of Parenti (1972) also microtrichiae are discernible on the papillae anales. This is a typical feature of all *Elachista* species except those of subgenus *Dibrachia*. It is here presumed that the female paralectotype of *E. totalbella* actually is a member of *Elachista* subgenus *Aphelosetia*, probably in the *dispunctella* complex. Therefore, the true female of *E. totalbella* is considered unknown.

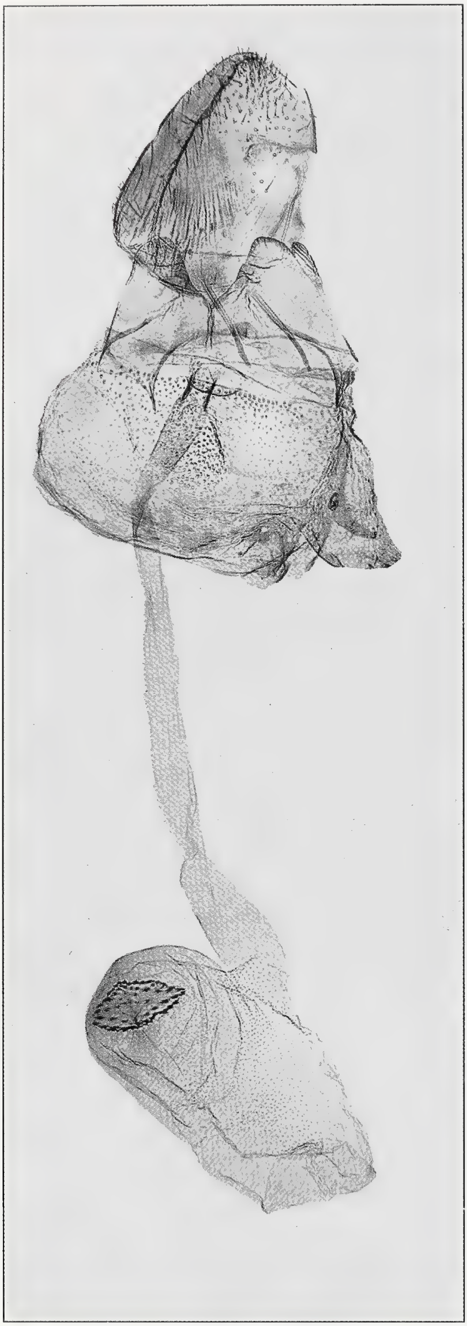


Fig. 32. Female genitalia of *Elachista alicanta* sp. n. (paratype, L. Kaila prep. n. 4222).

Elachista anatoliensis Traugott-Olsen, 1990 (Figs. 7–8, 21–25)

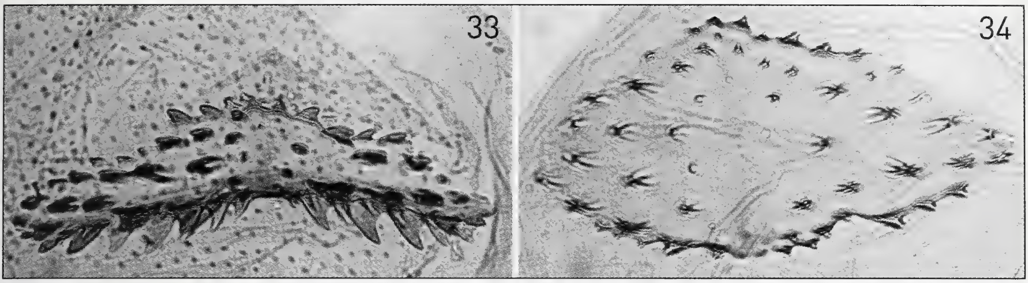
Elachista anatoliensis Traugott-Olsen, 1990: 275, figs. 3, 12, 13, 23, 24.

Dibrachia anatoliensis (Traugott-Olsen, 1990); Sinev and Sruoga 1992: 155.

Elachista (*Dibrachia*) *anatoliensis* Traugott-Olsen, 1990; Kaila 1999: 164.

Material. Holotype ♂, labelled: ”Type” [rounded label with red margin], ”genital praeparat | nr. C.3.12.89 sex: ♂ | E. Traugott-Olsen | WING praeparat | nr. B. 17.6.90 sex: ♂ | E. Traugott-Olsen”, ”Anatolia | Kizilcahaman | 1965”, ”*Elachista* | *anatoliensis* sp. n. | det. E. Traugott-Olsen” (TLMF). – 1♂ **Turkey**, Prov. Kayseri, 5 km NW Ercios Dagh., 2000 m, 22.vii.1986, Fibiger leg. (slide ETO E.19.6.89 [with identification label ‘*Elachista totalbella* Chrét. ETO det.]) (ZMUC); 1♂, same data, (slide A28.6.90 E. Traugott-Olsen, [with identification label ‘*E. anatoliensis* ETO det.]); 1♂ Ankara, Kizilcahaman, 20 km NW, 1200 m, 1.vii.1987, Fibiger leg. (slide G28.6.90 E. Traugott-Olsen, [with identification label ‘*E. anatoliensis* ETO det.]) (ZMUC); 2♂ Ürgüp, 30.vi.1998, Nupponen leg. (Kaila slides 3557, 3909) (coll. Nupponen, MZH). 1♂ **Turkmenistan**, Central part of the Kopetdagh Mts., 15 km W from Firyuza (now Poevryuze), Mt. Dushak, [2100 m, mountain xerophytous belt, *Juniperus* tree savanna-like forest], by light trap, 7.vii.1990, Dubatolov leg. (Kaila prep. n. 1682) (SZMN).

Diagnosis. An unicolorous white species that is externally separable from the similarly coloured species of subgenus *Dibrachia* as well as from the *Elachista* (*Aphelosetia*) *argentella* group by the very narrow forewings (Figs. 7–8). The genitalia also readily separate *E. anatoliensis* from the *E. argentella* group species. The genitalia of



Figs. 33–34. Signum of *Elachista alicanta* sp. n. **33.** Paratype, L. Kaila prep. n. 4217. **34.** Paratype, Kaila prep. n. 4222.

E. anatoliensis differ from other *Dibrachia* species as follows: The valva is longer and narrower than in the other species, being four times longer than wide, and the digitate process is absent. The juxta lobes are broader than in *E. totalbella* for which the digitate process is very small (Figs. 21–25).

Description, ♂. Forewing length 4.4–4.9 mm. Length of labial palpus 1.3 times diameter of head, white, second segment slightly ochreous below. Scape dense, white, pecten and pedicel of antenna white, flagellum grey. Head white, ochreous above; neck tuft, patagia and thorax white. Abdominal segments basally shiny light grey, distally white. Fore- and midleg inwardly pale, outwardly mottled grey, hindleg ochreous white, tibia and tarsal articles outwards mottled grey, distally white. Forewing very narrow, unicolorous white, fringe concolorous. Hindwing pale grey, somewhat translucent, fringe ochreous white. Underside of forewing grey, fringe white; underside of hindwing as upper side. Female unknown.

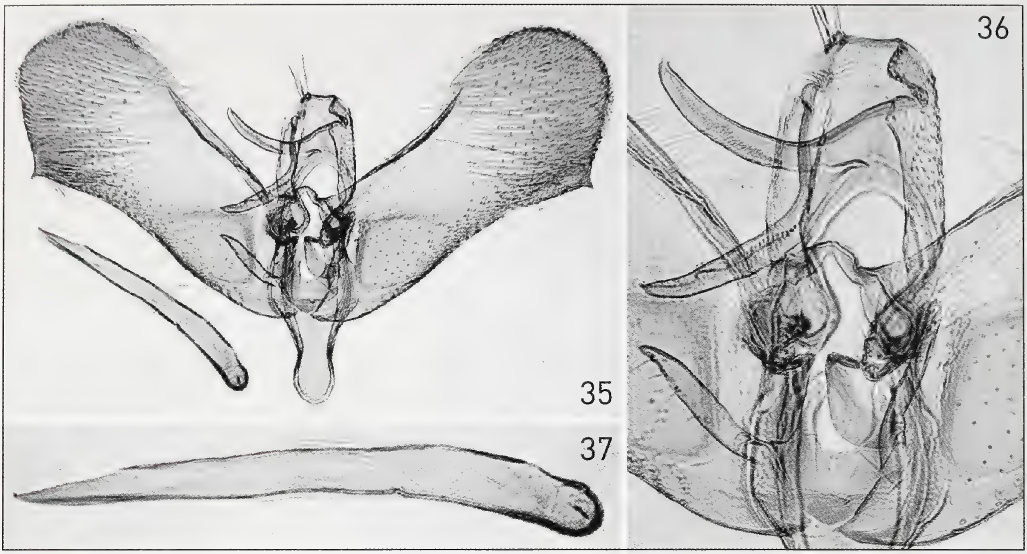
Male genitalia. Uncus lobes low, triangular, setose. Lobes of spinose knob of gnathos separate, narrow, elongate, with comb-like, longitudinal double row of spines, over 1/4 length of valva. Valva narrowest medially, four times longer than wide at narrowest point, with somewhat sclerotised valval process on ventral surface; costal sclerotisation not folded; sacculus weakly s-shaped, with small spine apically, cucullus expanded, rounded. Ventral shield of juxta sickle-shaped, dorsolaterally extended; juxta lobes widely set apart from each other, narrowly connected to median plate of juxta, distinctly sclerotised, without setae; triangular setose lobe present between juxta lobe and valval process. Digitate process absent. Vinculum narrow, v-shaped, with distinctive median ridge. Phallus 2/3 length of valva, basally bent, distally tapered to pointed, straight apex; blunt caecum with manica; vesica without cornuti.

Female. Unknown.

Life history. The specimens from Ürgüp were found in an area with exposed limestone (K. Nupponen, personal communication).

Distribution. Greece, Turkey, Turkmenistan.

Remarks. New to Turkmenistan. Traugott-Olsen (1990: fig. 24) mentions that *E. anatoliensis* possesses a paddle-shaped, unsetose digitate process. This structure is actually the juxta lobe (cf. Figs. 22, 24) and the structure interpreted to be the 'usual' juxta lobe as in *Elachista* in general is the lobe of the valval process.



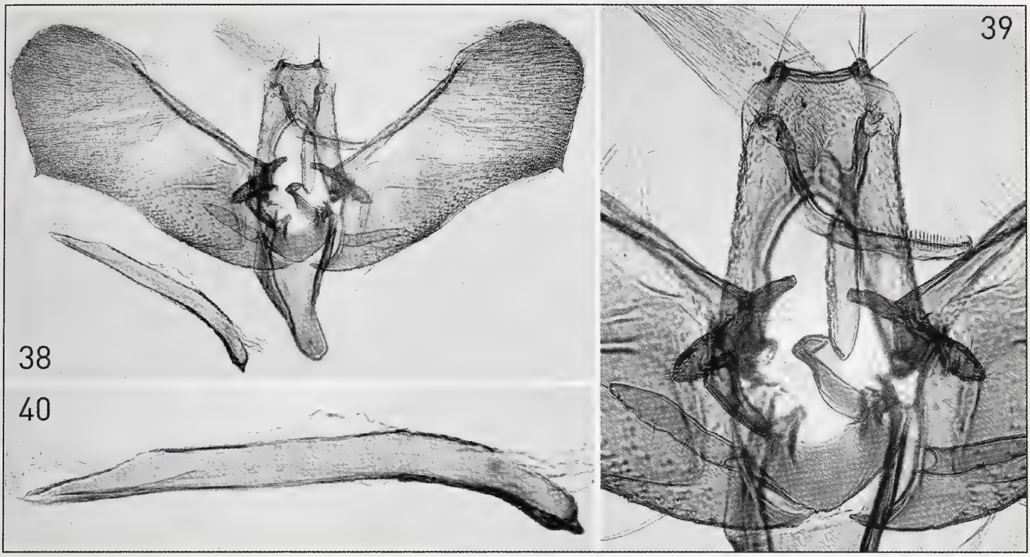
Figs. 35–37. Male genitalia of the holotype of *Elachista elksourensis* sp. n. (L. Kaila prep. n. 4141). **35.** General view. **36.** Details of uncus, gnathos, and juxta. **37.** Phallus.

Elachista alicanta sp. n. (Figs. 1, 9–10, 26–34)

Material. Holotype ♂: “Spanien, Alicante | Sierra de Crevillente | 5 km N. Albatera, 450 m | 38°15.22’N, 00°54,86’W | 23.v.2004 leg. P. Huemer leg. | TLMF2005-04”, “L. Kaila | prep. no. 4193”, “TLMF”, “Holotype | *Elachista* | *alicanta* | Kaila” (TLMF). – Paratypes: 22♂, 15♀, same data as holotype, except 2♀ 24.v.2004, 5♀ 26.v.2004 (TLMF, 2♂ 2♀ MZH).

Diagnosis. A very narrow-winged species, like *E. anatoliensis*. The forewing colour is, however, mottled grey with distinct plical and discal spots, unlike any other species of subgenus *Dibrachia* which all share a typical silky white forewing ground colour (Figs. 9, 10). Externally, *E. alicanta* could rather be mixed with *Stephensia unipunctella* Nielsen & Traugott-Olsen, *E. fuscibasella* Chrétien of the *Elachista* (*Aphelosetia*) *argentella* group, or representatives of the *Elachista* (*Elachista*) *biatomella* complex, all of which may co-occur with *E. alicanta* in southern Spain. However the new species has narrower forewings than any of these species. The genitalia also readily separate these unrelated taxa, and the absence of a developed uncus is visible without dissection. From other *Dibrachia* species it is characterised by the following characteristics in the male genitalia: the digitate process is elongate and narrow, resembling that of *E. elksourensis*, but the phallus contains one or two small cornuti (Figs. 26–31).

Description. Forewing length of ♂ 5.0–5.5 mm, ♀ 4.0–4.5 mm. ♂: Labial palpus 1.5 times longer than diameter of head, bluish white, second and third segments fuscous below on distal halves. Head white, scales more or less dark grey-tipped above. Scape and pedicel of antenna covered with pale grey and dark grey-tipped scales, pecten leaden grey; flagellum grey, weakly annulated by slightly darker rings. Neck tuft, tegula, and thorax covered with pale grey and dark grey-tipped scales, abdomen ochreous grey. Legs inwardly pale grey, outwardly leaden grey, tibia and tarsal articles of hindleg with bluish white distal rings. Forewing narrow, ground colour appearing mottled grey due



Figs. 38–40. Male genitalia of the paratype of *Elachista elksourensis* sp. n. (L. Kaila prep. n. 4259). **38.** General view. **39.** Details of uncus, gnathos, and juxta. **40.** Phallus.

to basally greyish white and distally dark grey-tipped scales, basal 1/5 of costa dark grey; elongate black spot at 1/2 wing length on fold, another similar spot at 3/4 wing length in middle. Fringe basally greyish white, distally dark grey, with blackish fringe line. Hindwing grey with concolorous fringe. Underside of forewing dark grey, fringe paler with creamy tinge. Underside of hindwing as upper side. Female otherwise as male but forewing shorter and broader, paler, ground colour formed by basally white and distally grey scales.

Male genitalia. Uncus lobes low, triangular, setose. Lobes of spinose knob of gnathos separate, narrow, elongate, with comb-like longitudinal double row of spines, 1/4 of length of valva. Valva narrowest medially, three times longer than wide at narrowest point, with somewhat sclerotised valval process on ventral surface; costal sclerotisation not folded; sacculus weakly s-shaped, with small spine apically, cucullus expanded, rounded. Ventral shield of juxta semicircular, dorsolaterally extended; juxta lobes widely set apart from each other, narrowly connected to median plate of juxta, distinctly sclerotised, without setae; narrow, triangular and distally pointed setose lobe present between juxta lobe and valval process. Digitate process s-shaped, elongate and narrow, setose. Vinculum narrow, u- or v-shaped, with weak median ridge. Phallus 2/3 length of valva, basally bent, distally tapered to pointed, straight apex; blunt caecum without manica; vesica with one or two straight cornuti.

Female genitalia. Papillae anales sclerotised, dorsodistally fused forming sharp blade, basally longitudinally wrinkled, sparsely covered with sensilla, lacking microtrichiae. Apophyses posteriores short, narrow; apophyses anteriores very short, triangular, distally pointed. Posterior margin of sternum 8 reinforced, with u-shaped median incision. Ostium bursae at anterior margin of sternum 8, membranous. Without antrum; ductus seminalis membranous, tubular, incepted to ductus bursae cephalad of colliculum at posterior 1/20 length of ductus bursae; ductus bursae tubular, straight, three times longer than corpus bursae; corpus bursae with internally directed spiculae; with one dentate signum variable in shape.

Life history. Specimens were collected flying freely at dusk while some were attracted to light. The habitat is a xerothermic steppe slope on calcareous soil.

Distribution. Only known from southern Spain.

Elachista elksourensis sp. n. (Figs. 6, 35–40)

Material. Holotype ♂: "Tunisia, Atlas Mtns. | Le Kef 40 km SE | nr. El Ksour village | dry meadow close to chalk | mine, 800 m, 02.v.2000 | K. Nupponen leg"., "L.Kaila | prep. no. 4141", "Holotype | *Elachista* | *elksourensis* | Kaila", coll. Nupponen. – Paratype: ♂, same data as holotype (Kaila prep. n. 4259), MZH.

Diagnosis. A white species for which the sharp black irroration characterises it within subgenus *Dibrachia* (Fig. 6). Externally it resembles large representatives of the *Elachista* (*Aphelosetia*) *dispunctella* complex, which, however, usually show forewing plical and discal spots, even though these are sometimes irregularly delimited. The genitalia, notably the externally discernible absence of a well-developed uncus, will immediately distinguish *E. elksourensis* from them. From other *Dibrachia* species it is characterised by the following characteristics in the male genitalia: the digitate process is elongate as in *E. alicanta*, but the phallus contains no cornuti (Figs. 35–40).

Description, ♂. Forewing length 5.0 mm. Length of labial palpus 1.3 times diameter of head, white, second segment slightly ochreous – fuscous below. Scape, pecten, and pedicel of antenna white, flagellum grey. Head, neck tuft, patagia, and thorax white. Abdominal segments basally shiny light grey, distally white. Fore- and midleg inwardly pale, outwardly mottled grey, hindleg ochreous white, tibia and tarsal articles outwards mottled grey, distally white. Forewing white, irregularly irrorated with black-tipped scales especially in median and distal area, basal 1/5 costa narrowly dark grey; fringe white. Hindwing grey, fringe ochreous white. Underside of forewing leaden grey, fringe white; underside of hindwing as upper side. Female unknown.

Male genitalia. Uncus lobes low triangular, setose. Lobes of spinose knob of gnathos separate, narrow, elongate, with comb-like longitudinal double row of spines, 1/5 length of valva. Valva narrowest medially, three times longer than wide at narrowest point, with somewhat sclerotised valval process on ventral surface; costal sclerotisation not folded; sacculus weakly s-shaped, with small spine apically; cucullus expanded, rounded. Ventral shield of juxta sickle-shaped, dorsolaterally extended; juxta lobes widely set apart from each other, narrowly connected to median plate of juxta, distinctly sclerotised, without setae; triangular setose lobe present between juxta lobe and valval process. Digitate process elongate tongue-shaped, setose, distally obliquely tapered. Vinculum narrow, u-shaped, distally broadened, with indistinct median ridge. Phallus 2/3 length of valva, basally bent, distally tapered to pointed, straight apex; blunt caecum without or with small manica; without cornutus.

Female. Unknown.

Life history. The specimens were collected in a dry treeless meadow close to chalk mine. The area is calcareous, although no exposed limestone was visible on the surface.
Distribution. Only known from Tunisia, Atlas Mts.

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De Prins, Willy & Jurate De Prins 2005. Gracillariidae (Lepidoptera). – World catalogue of insects 6. – Apollo Books, Stenstrup. 502 pp. – Hardcover
(ISBN 87-88757-64-1). DKK 760.00 (excluding postage). (in English)

In many terms Gracillariidae are a remarkable group of Lepidoptera. Many species are characterised by beautiful forewings showing a metallic pattern through the stereo-microscope. The larvae are leafminers with a tendency to oligophagy or monophagy; therefore, they are easy to find in nature, and they are easy to breed. With these characters, a number of entomologists became fascinated by gracillariids and started to work on Microlepidoptera. Due to their phytophagous habits, some gracillariids are of economic importance and the group is of interest to applied entomologists also. Just during the last decade, the horse-chestnut leafminer (*Cameraria ohridella* Deschka & Dimic, 1986) spread throughout Europe, heavily infesting the leaves of *Aesculus hippocastanum*, to become one of the most studied lepidopterous species in Europe and remarkably well known to non-entomologists who are normally hardly able to recognise more than 15 species of Lepidoptera by their common name.

The sixth volume of the "World catalogue of insects" series, by Willy & Jurate De Prins, is dedicated to the Gracillariidae, a diverse family counting 1809 species, for which 517 synonyms are recorded. The species are grouped into 98 genera, for which 34 synonyms are mentioned.

The introductory section gives statistics on the number of descriptions of gracillariid species during the decades since 1758 and detailed information on the sources used to compile the catalogue as well as on the organisation of the database on which the catalogue is based. Details are also given on the arrangement of the catalogue and on the definitions of the zoogeographical regions. A list of abbreviations of museums storing gracillariid types is given. The introductory part ends with an overview of the changes in the classification of this lepidopterous group through time.

The catalogue itself is divided into seven parts: (1) family group names, (2) genus- and species-group names, (3) fossil species, (4) unavailable names, (5) unplaced species, (6) taxa transferred to other families, and (7) addenda. The catalogue is comprehensive regarding the information given. It starts with the currently valid family-group names Gracillariidae, Gracillariinae, Lithocolletinae, and Phyllocnistinae, giving author, year and reference of original description, the original spelling of the taxon name as well as the same information for the synonyms belonging to each valid name. Additional nomenclatural remarks are made where necessary. The same information is given for genera, which are ordered alphabetically, and for species, which are ordered alphabetically within each genus. For generic names, type species and designation of type species are given too. In the comprehensive treatment of the species, information is also given on type locality, number and deposition of type specimens, larval host-plants and parasitoids with references to the source for this information, as well as distribution by zoogeographical region and country. At the end of the book, a full bibliography and three indices for the scientific names of parasitoids, plants, and lepidopterans are given.

The book is easy to use, as different starting points can be used to find information via the contents, the alphabetical order within the catalogue and/ or the indices. All information given is linked to the relevant literature sources, of which the references are given in the bibliography. This makes all nomenclatural and additional information given verifiable. Hopefully this format will be used as a standard for similar projects in other groups of Lepidoptera.

The world catalogue of Gracillariidae is an excellent and comprehensive source of information to all those working with these insects, whether they are basic or applied entomologists or whether they are interested in the systematics or the relationships of gracillariids with plants and parasitoids. The book will certainly stand as a basic tool for working with Gracillariidae, though the current zeitgeist seems to favour electronic databases. Still, many readers prefer to have a 'stand-alone' source of information that shows the 'state of the art' at a certain date.

MATTHIAS NUSS

SOCIETAS EUROPAEA LEPIDOPTEROLOGICA e.V.

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Type specimens of 'Cossidae' described by W. Koshantschikov

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Abstract. The type material of *Duomitella relicta* Koshantschikov, 1923 and *Stygia gerassimovii* Koshantschikov, 1923 is revised, and lectotypes for both taxa are designated. One new synonym *Brachodes appendiculata* (Esper, 1783) = *Stygia gerassimovii* Koshantschikov, 1923, **syn. n.** is established and the synonymization of *Duomitella relicta* Koshantschikov, 1923 with *Scardia polypori* (Esper, 1786) (Tineidae) is confirmed.

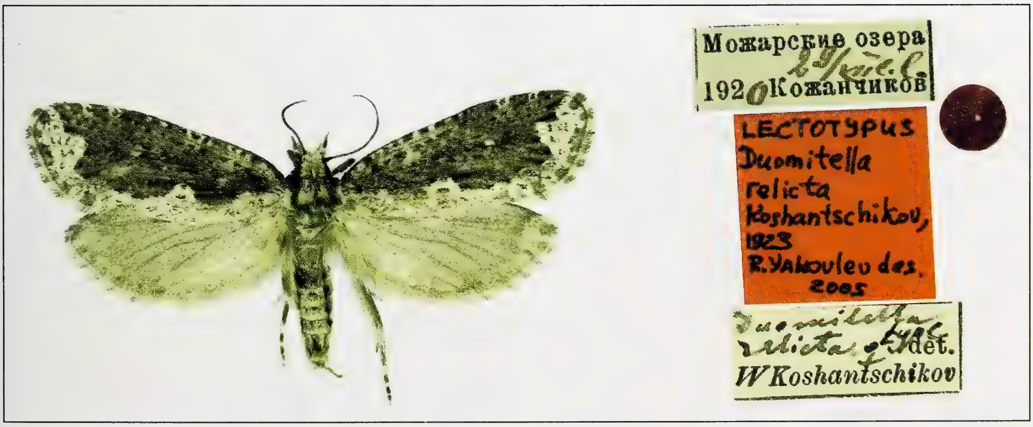
Key words. Cossidae, Tineidae, Brachodidae, lectotypus, synonymy, Siberia, Minusinsk.

In his paper "Materialen zur Macrolepidoptera Fauna des Minussinsk [sic] Bezirkes (Siberien Ienisey Gouv.)" Koshantschikov (1923) described two new species of Cossidae (Lepidoptera), *Duomitella relicta* and *Stygia gerassimovii*. For the first species, a new monotypic genus *Duomitella* was also erected. The descriptions were rather detailed, but no figures were given. During work at the Zoological Institute of Russian Academy of Sciences (St. Petersburg) I found the type material of these two species. Hereby I designate lectotypes and discuss the systematic position of these taxa. My designations of these lectotypes arc mach within the framework of my preparation of a catalogue of the Cossidae of the Old World.

Duomitella relicta Koshantschikov, 1923: 22–25 (Figs. 1–2)

References: Zagulyaev 1973: 89 (= *Scardia polypori* (Esper, 1786)); Schoorl 1990: 242; Yakovlev 2004: 155 (= *Scardia polypori* (Esper, 1786)).

Material. Lectotype (**here designated**): ♀ in perfect condition with labels: 1- (rectangular yellowish paper typed label) "Можарские озёра [Mozharskie lakes] | 29.07. e.[x] l.[arva] | 1920, Кожанчиков [Koshantschikov]"; 2- (red circle); 3- (rectangular yellowish paper label with inscription made by Koshantschikov in black Indian ink) "*Duomitella* | *relicta* ♂ type" (and typed inscription) "Koshantschikov det.",; 4- (rectangular red author's label) "Lectotypus | *Duomitella* | *relicta* | Koshantschikov, | 1923 | R. Yakovlev des. | 2005". 1♂, 1♀ are designated paralectotypes.



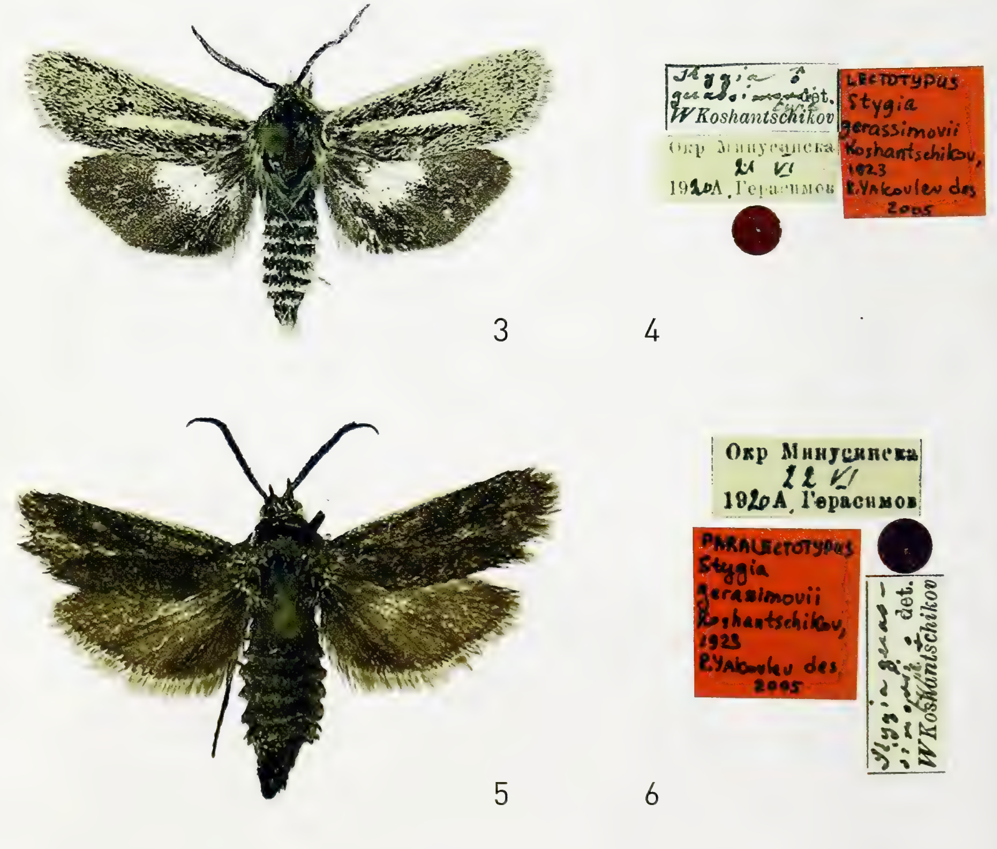
Figs. 1–2. *Duomitella relicta* Koshantschikov, 1923. **1.** Lectotype. **2.** Labels of lectotype.

The species was described from 1♂ and 2♀ collected in “Mozharskie” marshes [E part of Minusinsk district, Tiberkul’ (Itkul’) lake]. It was later synonymized with *Scardia polypori* (Esper, 1786) (Tineidae) by Zagulyaev (1973). Schoorl (1990: 242) was not aware of Zagulyaev’s work, but, having analysed the original description, he also came to the conclusion that the taxon did not belong to Cossidae. My critical study of the type material of *Duomitella relicta* Koshantschikov, 1923 totally confirms Zagulyaev’s point of view.

Stygia gerassimovii Koshantschikov, 1923: 25–27, Syn. n. (Figs. 3–6)

References: Daniel 1954: 174; Schoorl 1990: 79; Yakovlev 2004: 161–162.

Material. Lectotype (**here designated**): ♀ in perfect condition with labels: 1- (rectangular yellowish paper typed label) “окр. Минусинска [near Minusink] | 21.06.1920 | Кожанчиков [Koshantschikov]“; 2- (red circle); 3- (rectangular yellowish paper label with inscription made by Koshantschikov in black Indian ink) “*Stygia* | *gerassimovii* ♂ type” (and typed inscription) “Koshantschikov det.”; 4- (rectangular red author’s label) “Lectotypus | *Stygia* | *gerassimovii* | Koshantschikov, | 1923 | R. Yakovlev des. | 2005 ”. 23♂, 2♀ are designated as paralectotypes.



Figs. 3–6. *Stygia gerassimovii* Koshantschikov, 1923. **3.** Lectotype. **4.** Labels of lectotype. **5.** Paralectotype, ♀. **6.** Labels of this paralectotype.

The species was described from 24♂ and 2♀ collected on Tagarsky island (river Yenisey, near Minusinsk). Afterwards, it was only mentioned as a member of Cossidae (Daniel 1955; Schoorl 1990; Yakovlev 2004), and only on the basis of the detailed original description. After a thorough analysis of Koshantschikov's description, Vladimir V. Dubatolov (Novosibirsk, Russia) assumed that the taxon could belong to Brachodidae. The same assumption was admitted by Axel Kallies (Australia).

My study of the type material shows that the taxon does in fact belong to Brachodidae and that it is conspecific with *Brachodes appendiculata* (Esper, 1783), a species known from South and Central Europe, southern Urals, northern Kazakhstan, and southern Siberia (Zagulyaev 1978).

Acknowledgements

I am grateful to S. Yu. Sinev (St. Petersburg) for his help during my work with the type material of the Zoological Institute, Russian Academy of Sciences, to V. V. Dubatolov (Novosibirsk) and Axel Kallies (Australia) for their fruitful comments on the analysis of the *Stygia gerassimovii* description, to J. W. Schoorl jr. (Holland) for his help in my search for rare publications, to Thomas Witt (Germany) for his all-round support of this investigation, and to V. V. Zolotuhin (Ulyanovsk) for his helpful comments during my work.

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Book Review

Barry Goater, Matthias Nuss & Wolfgang Speidel. Pyraloidea I (Crambidae: Acentropinae, Evergestinae, Heliothelinae, Schoenobiinae, Scopariinae). – *In*: Peter Huemer & Ole Karsholt (eds.), Microlepidoptera of Europe, Volume 4. – Apollo Books, Stenstrup. 304 pp. Hardcover (ISBN 87-88757-33-1). DKK 580.00.

This book's publication is welcomed after some delay, which allowed Volume 5 to be published ahead of volume 4. The size and binding is similar to earlier volumes in this series. It begins with an abstract detailing taxonomic changes, there is then an introductory chapter on the Pyraloidea describing the morphology of adults, their head, wings, tympanal organs and male and female genitalia. The classification of Pyraloidea at family level has long been a matter of debate, this book departs from the practice embodied e.g. in Karsholt & Razowski (1996) by using two families: Pyralidae and Crambidae to separate the superfamily. The differences are well known to taxonomists, Munroe (1972) and most authors following him retained the well known name Pyralidae for the benefit of non specialists and used the terms Crambiform and Pyraliform to separate the two categories. Others have argued that the superfamily name is sufficient to encompass the two groups and this position is accepted here. It means that non specialists who recognised Pyralinae and Pyraustinae *s.l.* as the broad winged mesolepidoptera will have to remember to call them Pyraloids rather than Pyralids. The differences between these groups are clearly set out in a table and the subfamilies belonging to each are listed in alphabetical order, without any attempt to show their familial relationships. There follow some brief notes about collecting and the preparation of moths and their genitalia. No reason is given for the arbitrary selection of five Crambid subfamilies, but it is assumed that this is made necessary by the state of knowledge and availability of specialists in those groups. A checklist of species is given with a number assigned to each, the same number being used consistently for the species descriptions and genitalia illustrations. Sensibly, introduced species are assigned letters, rather than numbers, which would interrupt the sequence of European species. There then follows the treatment of the respective subfamilies and their species. For the Acentropinae the introduction is longer and includes a cladogram of the genera and additional morphological details. The species accounts follow including a full synonymy, brief diagnosis, description of male and female genitalia, distribution and biology. The Evergestinae have a shorter introduction, the species accounts generally contain a longer diagnosis. Species from north Africa are also included; the final two species are headed "Taxa incertae sedis" and left in their original genus. The Heliothinae contains but one species in Europe and so this subfamily does not take many pages, Schoenobiinae are treated in a similar manner to Acentropinae, with a few keys included. The Scopariinae, on account of their greater numbers, occupy about half of the book. The species accounts are concise but appear accurate. There follows a Distribution table for all species, where the occurrence in each country is tabulated. This follows the pattern of Karsholt & Razowski with some refinements, but different symbols described in the introduction are used by some authors and not others. Scopariinae species have the country's letters in upper case only if they have been verified by the author. Parentheses for introductions are used without explanation, and brackets for extinct species are used, but not consistently. The colour plates showing the adults are made from photographs and are very clear. The Scopariinae are featured on one plate natural size, but also on subsequent plates at 1.75 × natural size. Each specimen figured has the data for that specimen detailed on the opposite page. Next the male genitalia are illustrated, the Acentropinae, Evergestinae and Schoenobiinae by fine line drawings, the remainder by photographs. Finally are the references and index. In any multi-author work of this size there are likely to be errors and inconsistencies; for example the original spelling of *andalusicum* is given in the checklist and species description, but is changed to *andalusica* in the index and illustrations, *Parapoynx stagnalis* is stated as being introduced to England, even though the author himself pointed out that this was a misidentification and gives the reference to the correction! The distribution of *Scoparia ancipitella* is stated to be Lowland to montane without it saying exactly where. Despite these minor shortcomings this volume must be warmly welcomed, and the treatment of the Scopariinae is sure to remain a masterpiece for a difficult group.

David Agassiz

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Perizoma onurcani sp. n. from Turkey (Geometridae: Larentiinae)

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Abstract. The description of a new geometrid moth, *Perizoma onurcani* **sp. n.**, from northern Turkey (Trabzon Province) is given. The holotype and two paratypes (all females) of the new taxon are kept in the collection of the University of Mustafa Kemal, Hatay, Turkey (UMKH).

Zusammenfassung. *Perizoma onurcani* **sp. n.** wird aus der nördlichen Türkei (Provinz Trabzon) beschrieben. Der Holotypus und zwei Paratypen (alles Weibchen) der neuen Art werden in der Sammlung der Mustafa Kemal Universität, Hatay, Türkei (UMKH) aufbewahrt.

Key words. Lepidoptera, Geometridae, *Perizoma onurcani*, new species, Turkey.

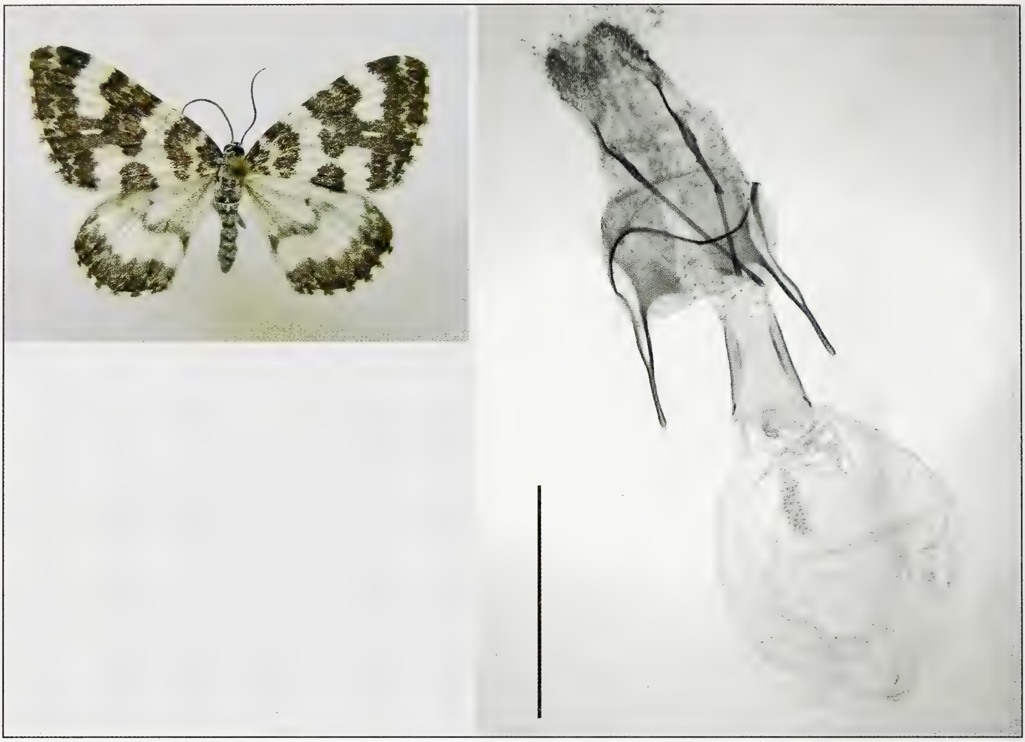
Introduction

After the publications of Riemis (1994), Viidalepp (1996) and Mironov (2000, 2003) on the geometrid moths of Turkey, Transcaucasus (which belonged to the former U.S.S.R.), and Europe, the species of the genus *Perizoma* Hübner, 1825 of the fauna of Asia Minor were thought to be well known. Up until now, eight species of this genus have been recorded from the territory of Turkey, i.e. *P. alchemillata* (Linnaeus, 1758), *P. hydrata* (Treitschke, 1829), *P. parahydrata* Alberti, 1969, *P. gigas* Wiltshire, 1976, *P. bifaciata* (Haworth, 1809), *P. blandiata* ([Denis & Schiffermüller], 1775), *P. albulata* ([Denis & Schiffermüller], 1775), and *P. flavofasciata* (Thunberg, 1792). Recently, however, a new geometrid species was found near Trabzon, in the northern part of Turkey. This species is externally reminiscent of representatives of the genera *Pseudobaptria* Inoue, 1982 (Inoue 1982; Sato 2002; Mironov 2003) and *Epirrhoe* Hübner, 1825 (Pierce 1914; Prout 1912-1916; Błeszynski 1965; Urbahn 1968) rather than to any other species of *Perizoma*. Nevertheless, the venation and the female genitalia of this species are typical of representatives of the genus *Perizoma* (Pierce 1914; Prout 1912-1916; Błeszynski 1965; Mironov 2000, 2003).

Perizoma onurcani sp. n.

Material. Holotype ♀. **Turkey**, Trabzon Province, Macka, Camlıduz, 40°45'N; 39°28'E, 1516 m, 30.vi.2005, at light, leg. F. Can (UMKH). Paratypes: 2♀, same data, but 1470 m, 16.vi.2003, at light, leg. O. Doganlar (slide no. 58) (UMKH).

Description (Fig. 1). Wingspan 26.5–28.0 mm; fore wing 14.5–15.0 mm. Labial palpi about 1.2 times diameter of eye. Frons and vertex covered with black and white scales. Antennae filiform, brown. Thorax dorsally covered with mixture of black and white scales. Fore wing broad with slightly arched costal and terminal margins and rounded



Figs. 1–2. 1. *Perizoma onurcani* sp. n., holotype ♀. **2.** Female genitalia of *Perizoma onurcani* sp. n. (slide no. 58).

apex; ground colour rich black and white; basal area broad, black, irrorate with white scales, with broken broad white transverse band in middle; outer border of black basal area evenly curved; medial area black, irrorate with white scales, broadened to costa, divided by narrow, longitudinal white band along Cu2 and connected with terminal area by two short, longitudinal black bands between M2-M3 and M3-Cu1; outer border of medial area strongly curved twice towards termen of fore wing; terminal area broad, black, with narrow, wavy white subterminal line forming small whitish spot at termen between M2 and M3. Fringe clearly chequered black and white. Hind wing rounded, broad; basal half covered with mixture of black and white scales; outer border of basal area sinuate, darker, blackish; transverse band between basal and terminal areas very broad and clearly white; terminal area broad, black, slightly irrorate with white scales, especially along inner border, with whitish wavy subterminal line; discal dot small, rounded or ovoid, black, placed in basal area closer to costal margin of hind wing; fringes as on fore wing. Abdomen pale grey, irrorate with black scales, with narrow black transverse bands along posterior margin of each segment.

Female genitalia (Fig. 2). Bursa copulatrix large, ovate, membranous, with one narrow, elongate scobinate signum. Ductus seminalis attached to posterior part of corpus bursae near base of colliculum. Colliculum collar-like, rather flat, large, elongate and broad, slightly tapered posteriorly. Antrum membranous. Tergite A8 rather broad with rounded posterior corners and broad, slightly sclerotized medial area. Anterior and posterior apophyses thin, elongate, slightly expanded at apices; posterior apophyses dilated at their bases. Basal arms of anterior apophyses connected with each other by a long and narrow, heavily sclerotized band encircling antrum. Papillae anales large, rather broad and elongate, covered with numerous medium-sized setae.

Habitat. The type series was collected at light at altitudes of 1,470 to 1,516 m above sea level. The natural vegetation in this area is 'plateau dominated' by forest roses, blackberry, privet, firebush, fern, wild strawberry, as well as forest trees such as spruce, fir, and beech.

Life history. The moths were collected while flying to the light of mercury vapor lamps (160 W). The immature stages are unknown.

Distribution. The species is known only from its type locality – the northern part of Asian Turkey (Trabzon Province).

Derivatio nominis. This species is dedicated to Onurcan - the son of Dr. Feza Can (Doganlar).

Remarks. This species is, externally, reminiscent of representatives of the genera *Pseudobaptria* and *Epirrhoe* rather than of any other species of the genus *Perizoma*. *Perizoma onurcani* sp. n. can be recognized readily and distinguished easily from any other Larentiinae species by the distinctive black and white maculation. The female genitalia are more similar to those of *Perizoma flavofasciata* (Thunberg, 1792), but clearly distinguishable by the shorter scobinate signum in the bursa copulatrix and the presence of a slightly longitudinally sclerotized, medial area on the eighth tergite. The relationship of *Perizoma onurcani* sp.n. with any other species of this genus is not known.

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Chesias angeri Schawerda, 1919 stat. rev., a long neglected species from northern Italy (Geometridae)

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Abstract. *Chesias angeri* Schawerda, 1919, has been discovered in north-eastern Italy (Friuli Venezia Giulia) for the first time since its description. The hitherto disputed species is characterized by an invariable unique pattern of the forewing and other external characters that differ from those of the related *C. rufata* (Fabricius, 1775). The male genitalia are very similar to those of *C. rufata*. However, the female genitalia exhibit significant differences and support separate specific status. Morphological characters of both species are figured.

Zusammenfassung. *Chesias angeri* Schawerda, 1919, wurde erstmals seit ihrer Beschreibung in Nordostitalien (Friuli Venezia Giulia) wiederentdeckt. Die bisher umstrittene Art zeichnet sich gegenüber der nahe Verwandten *C. rufata* (Fabricius, 1775) durch konstante Zeichnungsunterschiede im Vorderflügel sowie weitere habituelle Merkmale aus. Die männlichen Genitalien sind jenen von *C. rufata* sehr ähnlich, jedoch finden sich in den Weibchen signifikante Differenzen, die einen separaten Artstatus belegen. Morphologische Merkmale beider Arten werden dargestellt.

Key words. Lepidoptera, Geometridae, *Chesias angeri*, Italy.

Introduction

The genus *Chesias* Treitschke, 1825 is restricted to the western Palaearctic region where it comprises ten species (Scoble 1999). However, the taxonomy at the specific and subspecific levels is highly disputed even for the European fauna. Müller (1996) accepted five European species including *C. legatella* (Denis & Schiffermüller, 1775), *C. rufata* (Fabricius, 1775), *C. isabella* Schawerda, 1915, *C. pinkeri* Schawerda, 1939, and *C. zuellichi* Schawerda, 1939. However, according to Hausmann et al. (2005), *C. linogrisearia* Constant, 1888 is accepted as a valid species and *C. zuellichi* is regarded as a synonym of *C. pinkeri*, the latter, at the same time, being downgraded to a subspecies of *C. rufata*. Furthermore, *C. capriata* Prout, 1904 is considered a valid species, and not a subspecies of *C. legatella*.

The regional checklist of the Italian fauna (Raineri & Zangheri 1995) included two species only, viz. *C. legatella* and *C. rufata*. However, according to the above mentioned studies *C. capriata* and *C. linogrisearia* have to be added.

Despite all efforts the identity of another species from Italy remained obscure till now. The taxon described as *Chesias angeri* Schawerda, 1919, was either ignored by authors (Forster & Wohlfahrt 1981; Müller 1996; Raineri & Zangheri 1995), treated as a valid species (Scoble 1999) or considered as a synonym of *C. rufata* (Hausmann et al. 2005), based on the examination of a single male syntype without abdomen (Hausmann *in litt.*, referring to the examination of Viidalepp, the author of the forthcoming volume 3 of Geometrid Moths of Europe). However, the well known Austrian lepidopterist Karl Schawerda described *C. angeri* as a good species, based on three male specimens that were collected by A. Buchtik on 18th April 1918 at San Quirino, by Prof. F. Anger on 5th May 1918 at Muscoli near Cervignano, and by F. Wagner in May 1918 at Magredis (Schawerda 1919), all localities situated in the north-eastern corner of Italy (provinces of Udine and Pordenone). Additional material collected by Wagner from 10th to 18th April 1918 was not included in the original description (Wagner 1923). The very distinct external appearance left no doubt that it was a new species and Schawerda (1919) figured it in black and white.

For decades no further specimens of *C. angeri* were collected, despite some specific search by Pinker at the type locality Magredis (Kusdas & Thurner 1955). Consequently the latter authors regarded the species to be, possibly, a rare form of *C. rufata*. The lack of material probably contributed significantly to the ignorance and omission of the species in standard European literature. In recent years the second author was able to collect a series of *Chesias* that were tentatively identified as *C. rufata*. Discussions with the first author and examination of several specimens showed the rediscovery of *C. angeri*. Morphological characters such as wing markings and female genitalia leave no doubt as to specific status. Therefore, the species rank is re-established, the taxon is re-described, and the male and female genitalia are figured for the first time.

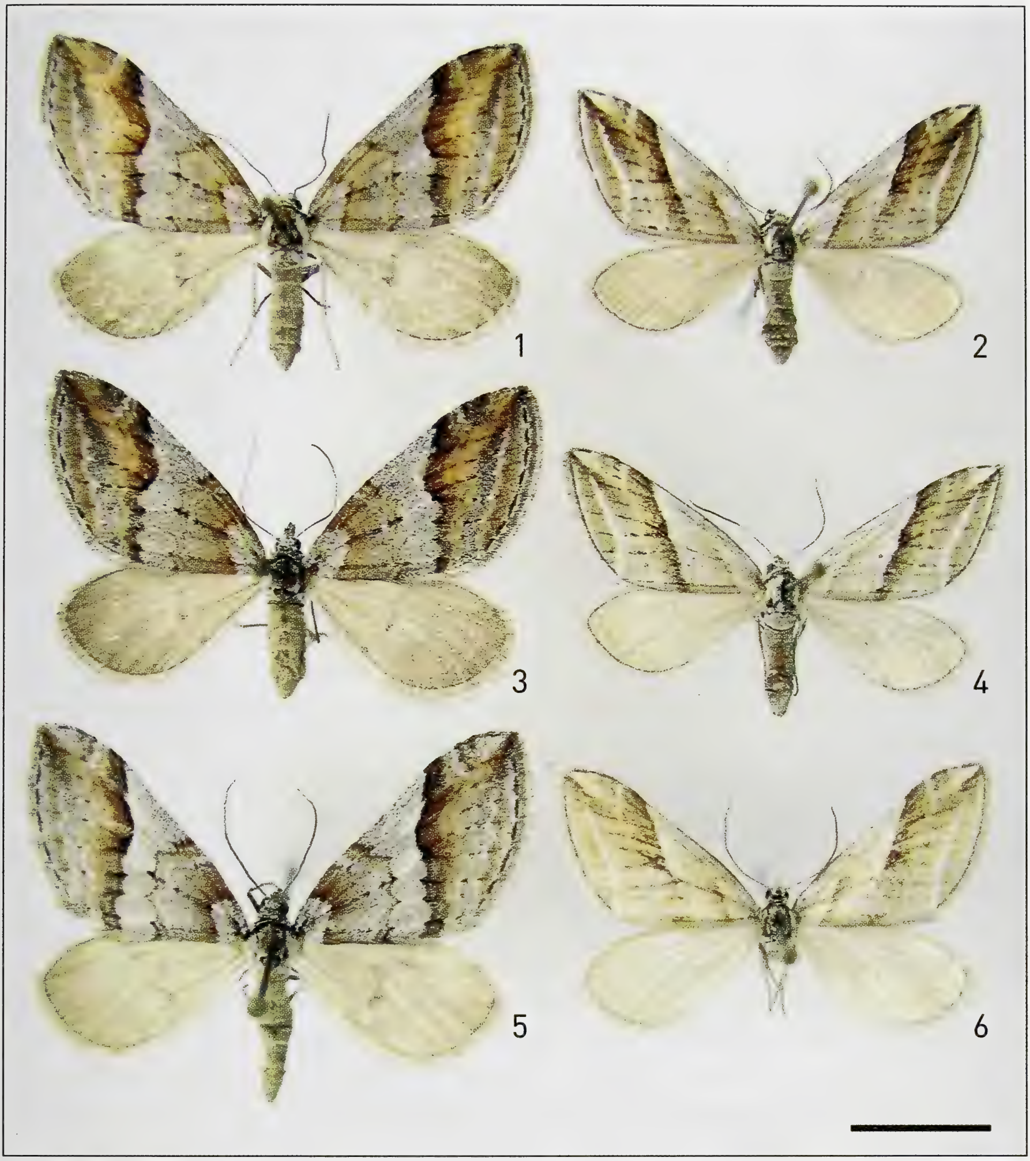
Chesias angeri Schawerda, 1919 stat. rev.

Material. 3♂, 5♀, Italy, prov. Udine, Campoformido, 80 m, 16.iv.2000, leg. Morandini; 2♂, 3♀, same data, but 21.iv.2000, 3♂, 3♀, same data, but 23.iv.2000; 2♂, same data, but 9.v.2003 (colls. Museo Friulano di Storia Naturale, Udine; Tiroler Landesmuseum Ferdinandeum, Innsbruck; Zoologische Staatssammlung, München; Morin, Monfalcone). The exact locality is not stated for conservation purposes.

Redescription. Adult (Figs. 2, 4, 6). Wingspan: ♂, 27 mm (n=1); ♀, 25–27 mm (n=5). Labial palpus porrect, brown, ventral and inner surface lighter, greyish brown. Frons, vertex, tegula and thorax greyish brown, mixed with some brown. Abdomen greyish brown, margins of segments lighter. Forewing rather narrow, pointed, termen oblique; ground colour light greyish brown with two darker lines almost parallel to termen; brown, narrow, oblique basal line at one fifth abruptly turned costad near subcosta; medial line almost absent, occasionally indistinctly developed with weakly light rust-brown area towards basal line; dark rust-brown, moderately broad, straight and oblique postmedial fascia from middle of inner margin towards two-thirds of costa; subterminal area with whitish line, slightly curved towards termen at tornus; area between termen and fascia suffused with dark brown scales; dark brown apical streak and dark brown, persistent terminal line present; hindwing light greyish-brown, without distinct markings.

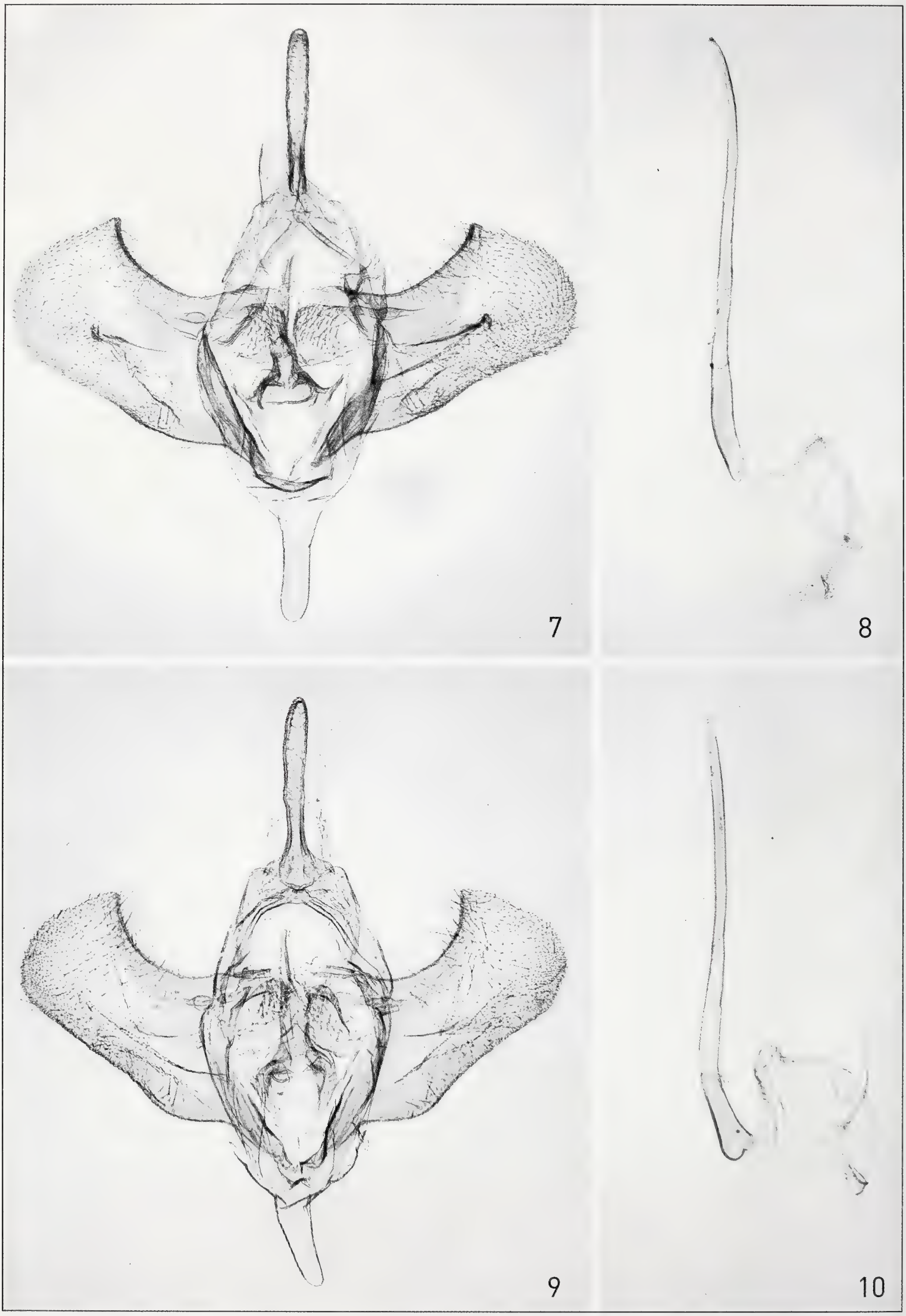
Genitalia ♂ (Figs. 9–10). Uncus long, almost clavate; tegumen narrow; valva broad, with sclerotized rod along ventromedial surface, saccular margin basally rounded, distal part slightly emarginated, apex of valva broadly rounded with pointed costal part; transtilla consisting of pair of broad and setose papillae; juxta with prominent, spine-like caudal process, lateral processes absent; vinculum with long, rod-like saccus, slightly shorter than uncus; phallus long and very slender, slightly curved near base.

Genitalia ♀ (Fig. 12). Papillae anales small; apophyses posteriores rather long, about two times length of tergum A8; apophyses anteriores short, about half length of



Figs. 1–6. Adults of *Chesias* species. **1, 3, 5.** *Chesias rufata* (Fabricius, 1775). **2, 4, 6.** *Chesias angeri* Schawerda, 1919. (scale bar = 1 cm)

tergum A8; tergum A8 sub-rectangular, with convex posterior and concave anterior margin; sternum A7 with broad and convex anterior margin, inserted by slightly sclerotized antrum; ductus bursae short, about length of segment A8, well sclerotized and slightly curved anteriorly, abruptly joining pear-shaped entrance of corpus bursae; corpus bursae large, main part almost globular, densely covered with star-shaped signa, less spinose posteriorly.



Figs. 7–10. Male genitalia of *Chesias* species. **7–8.** *Chesias rufata* (Fabricius, 1775). **9–10.** *Chesias angeri* Schawerda, 1919.

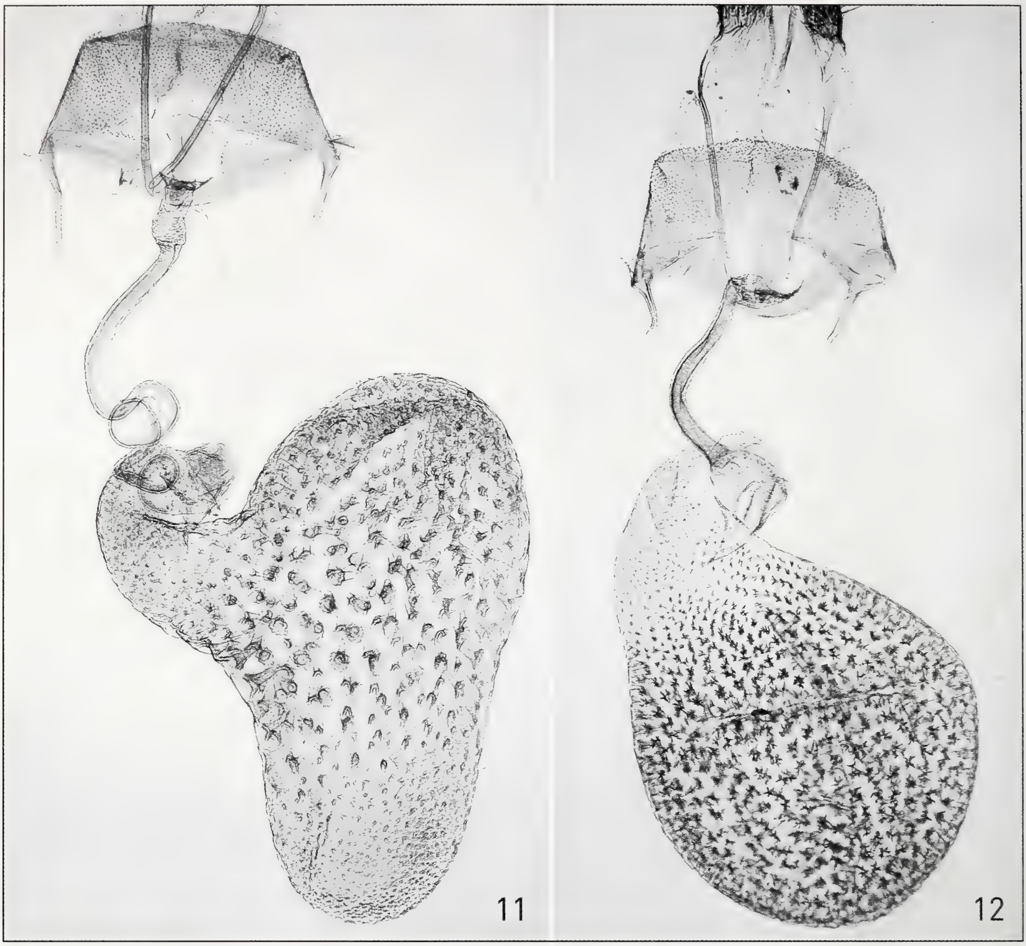
Differential diagnosis. *C. angeri* differs from *C. rufata* in numerous external characters (Figs. 1–6) that have all been described in details already by Schawerda (1919). Particularly the dark forewing markings of both species are completely different: the basal line and the post-medial fascia are almost parallel to the termen in *C. angeri* and the ante-medial line of *C. rufata* is completely absent. Furthermore, the distinct postmedial fascia of *C. rufata* is slightly angulate towards the cell and turns straight from about two-thirds of the costa to three-quarters of the inner margin where it ends right-angled. Instead of a slightly curved subterminal line *C. rufata* exhibits a straight whitish wavy line and the dark brown terminal line is interrupted in the latter species whereas it is persistent in *C. angeri*. Finally, *C. angeri* is smaller and more narrow-winged than *C. rufata* and the colour of its hindwings is lighter.

The genitalia are particularly distinct in the females (Figs. 11–12) throughout the genus. *C. angeri* is characterized by a comparatively short ductus bursae meeting the globular corpus bursae in the posterior section. In *C. rufata* the ductus bursae is much longer and caudally coiled, meeting the reniform corpus bursae laterally. The male genitalia of both species are very similar and alleged differences such as in the shape of the valva seem to underplay intraspecific variation (Figs. 7–10). However, only two males of *C. angeri* could be examined so far. The genitalia are also particularly similar to those of *C. rhegmatica* Prout, 1937, from Cyprus, which, however, is completely different externally.

Distribution. North-eastern Italy (Fig. 13). Only known from a few closely situated localities: Campoformido (prov. Udine, UTM UL 59); Cervignano del Friuli, Muscoli (prov. Udine, UTM UL 77); Povoletto, Magredis (prov. Udine, UTM UM61); San Quirino (prov. Pordenone, UTM UM 20). Reputedly occurring in Bosnia-Herzegovina (Scoble 1999), but this reference is based on a misinterpretation of the original description. Schawerda (1919) only mentioned that one of his collectors, A. Buchtik, who found the new species in San Quirino, had collected for him in the Herzegovina for several years in earlier times.

Life history. The habitat (Fig. 14) of *C. angeri* is permanent xerophilous meadows with a continuous sward and a rich flora of up to 60 species within 100 square meters. This vegetation grows on an alluvial gravel substrate, has never been fertilized, and is mown once or twice a year. Phyto-sociologically it belongs to the Onobrychio arenariae-Brometum erecti association with numerous xerophilous species such as *Onobrychis arenaria* (Kit.) DC., *Ononis spinosa* L., *Anthyllis vulneraria* ssp. *polyphylla* (DC.) Nyman (Fabaceae), *Thymus pulegioides* L. (Lamiaceae), *Knautia illyrica* Beck (Dipsacaceae), *Dianthus carthusianorum* ssp. *sanguineus* Vis. (Caryophyllaceae), *Filipendula vulgaris* Moench. (Rosaceae), *Bromus erectus* L. (Poaceae) and to signify acidification of the soil also *Genista tinctoria* L. (Fabaceae).

As far as known the larvae of the species of *Chesias* feed on *Cytisus* L. and *Genista* L. (Fabaceae) and those of *C. rufata* have been recorded from *Cytisus scoparius* (L.) Link. (= *Sarothamnus scoparius*) (Wall 1975). The yet undescribed mature caterpillar of *C. angeri* has been found by the second author from late May to mid-June, feeding on the flowers of *Genista tinctoria* L. It is 3 cm long, olive green with a lateral white line, and it has been observed several times and collected with a net on flowers of the



Figs. 11–12. Female genitalia of *Chesias* species. **11.** *Chesias rufata* (Fabricius, 1775). **12.** *Chesias angeri* Schawerda, 1919.

host-plant. Pupation took place in the ground and the adults emerged from the end of March to the end of April after the hibernation of the pupae. Wagner (1923) observed a number of specimens flying for short distances when disturbed, or flushed up from vegetation and resting on stalks of *Genista* sp. and other plants. The type locality at Magredis was dominated by *Calluna* Salisb. (Ericaceae) and *Genista* L. according to this author. Similarly, the second author observed the species during daytime. However, considering nocturnal activity patterns in related taxa, it is very likely that the adults are also attracted to light during the night. In the field the adults have been observed from mid-April to the first decade of May, indicating one generation.

Remarks. The type material of *C. angeri* could not be found in the collections of the Naturhistorisches Museum, Vienna. One syntype was borrowed for a plate of habitus photographs for the third volume of the book series 'Geometrid Moths of Europe.' The photograph was examined and conspecificity with our new material was confirmed (Hausmann pers. comm.).

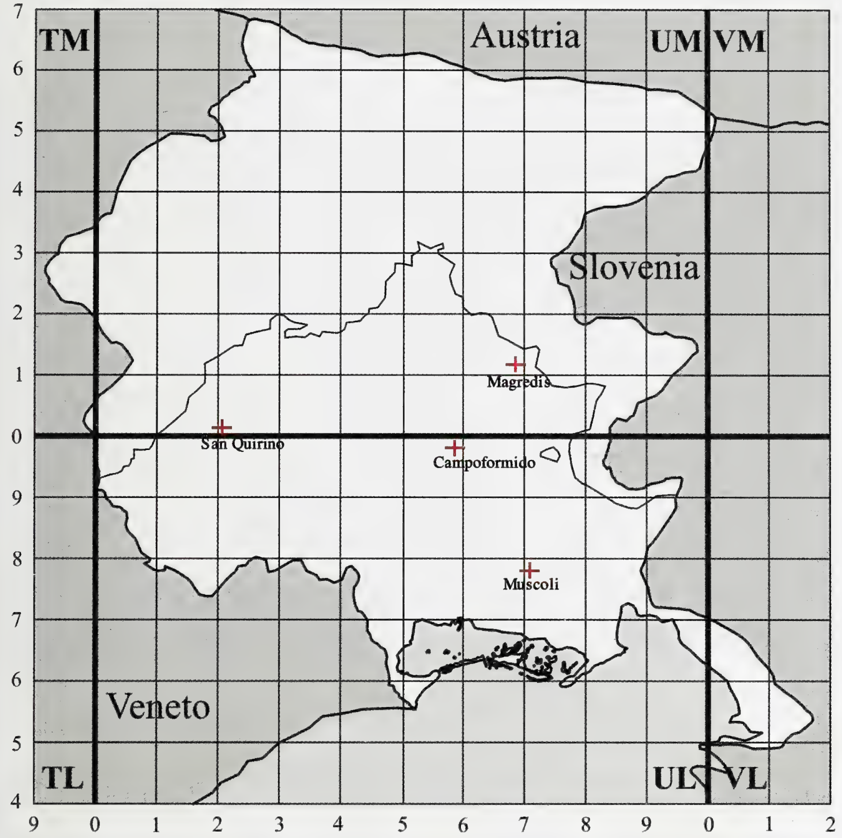


Fig. 13. Collecting localities of *Chesias angeri* Schawerda, 1919 (white area: Friuli Venezia Giulia, the northeastern region of Italy).

Discussion

The rediscovery of a striking species such as *C. angeri* is surprising, particularly within the well explored central European region. However, the faunistic composition of Lepidoptera in the north-easternmost part of Italy is still insufficiently known and numerous remarkable new records and even new species have been found in this area in recent years (Mikkola 1998; Huemer 2002a; 2002b; Huemer & Kaila, 2003; Huemer et al. 2005). Despite a strong human impact and the destruction of large parts of the Friulian plane by intensive agriculture some most remarkable relict habitats that are unique within Europe are restricted to this area. Beside the last large and natural alpine river systems with tremendous gravel shores e.g. along the rivers Tagliamento, Meduna and Cellina, a specialised type of xerophilous meadow (the so-called "magredi") growing on alluvial gravely substrate is typical for the central parts of the plane. It varies from discontinuous vegetation to continuous herbaceous covering and is inhabited by a

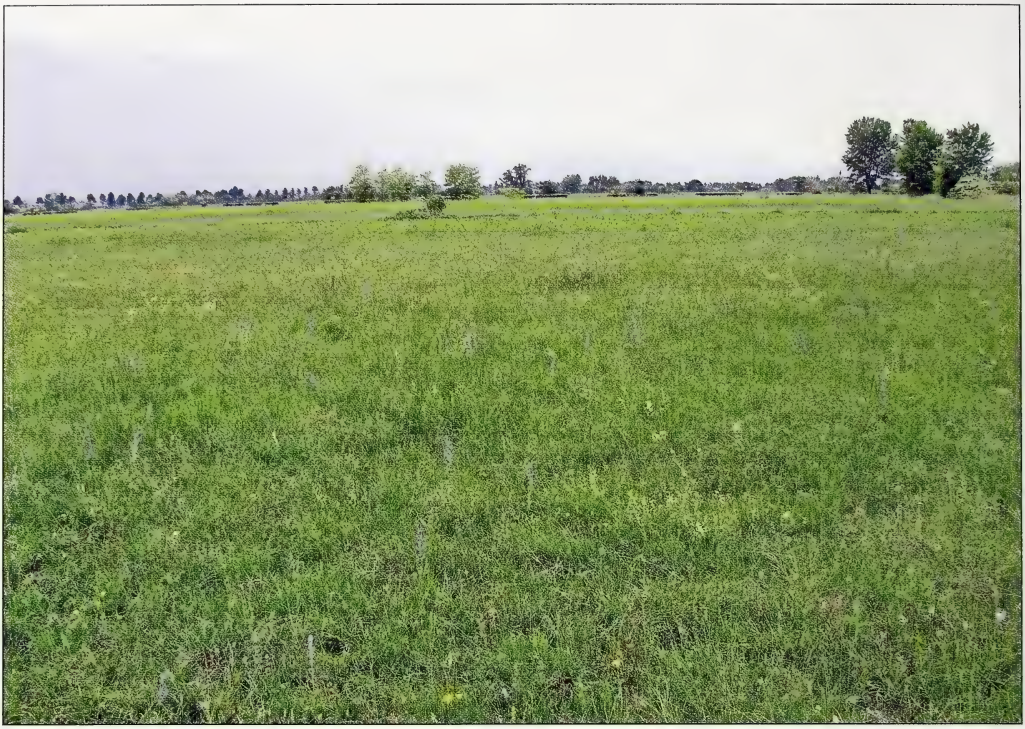


Fig. 14. Habitat of *Chesias angeri* Schawerda, 1919.

remarkable flora and fauna which even includes some discontinuously distributed local endemic plants, e.g. *Brassica glabrescens* Poldini (Brassicaceae), *Knautia ressmannii* (Pacher) Briq. (Dipsacaceae), *Centaurea dichroantha* A. Kern. and *Leontodon berinii* (Bartl.) Roth. (Asteraceae). However, the lepidopterous community of this habitat type is explored insufficiently though some interesting species have been found recently, e.g. undescribed species of *Apatetris* sp. and *Megacraspedus* sp. (Gelechiidae), *Trifurcula trasaghica* Lastuvka & Lastuvka, 2005 (Nepticulidae), or the first Italian records of *Scrobipalpa halonella* (Herrich-Schäffer, 1854), *Stenoptilia mariaeluisae* Bigot & Picard, 2002 (Pterophoridae) and *Asartodes monspesulalis* (Duponchel, 1833) (Pyralidae). The habitat of *C. angeri* cannot be considered as typical "magredi" but instead an advanced succession stage of xerophilous meadows with continuous vegetation. This kind of habitat is particularly endangered and highly fragmented and even the extent of formerly widely distributed "magredi" in a wider sense has been reduced to less than 1000 ha during the last century.

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A new species of *Agonopterix* feeding on giant hogweed (*Heracleum mantegazzianum*) in the Caucasus, with a discussion of the nomenclature of *A. heracliana* (Linnaeus) (Depressariidae)

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Abstract. *Agonopterix caucasiella* sp. n. is described and compared with its closest relatives, *A. ciliella* (Stainton, 1849) and *A. heracliana* (Linnaeus, 1758). Adults and genitalia of these species are figured. The life history of *A. caucasiella* sp. n. in the Caucasus is described. Its larva feeds in the umbels of *Heracleum mantegazzianum* Sommier & Lévier (Apiaceae) (giant hogweed), an invasive weed in Europe, which is moreover toxic to human skin. The complicated and controversial nomenclature of the related *A. heracliana* (Linnaeus) (*Phalaena* (*Tortrix*)) is discussed, as is that of *Depressaria heracliana* (Linnaeus) sensu auctt. For the latter the name *D. radiella* (Goeze, 1783) is valid, whereas *D. heraclei* (Retzius, 1783) is shown to be invalid. A lectotype is designated for *Pyralis applana* Fabricius, 1777. *Phalaena radiella* Goeze, 1783 is fixed as the type-species of *Depressaria* Haworth, 1811.

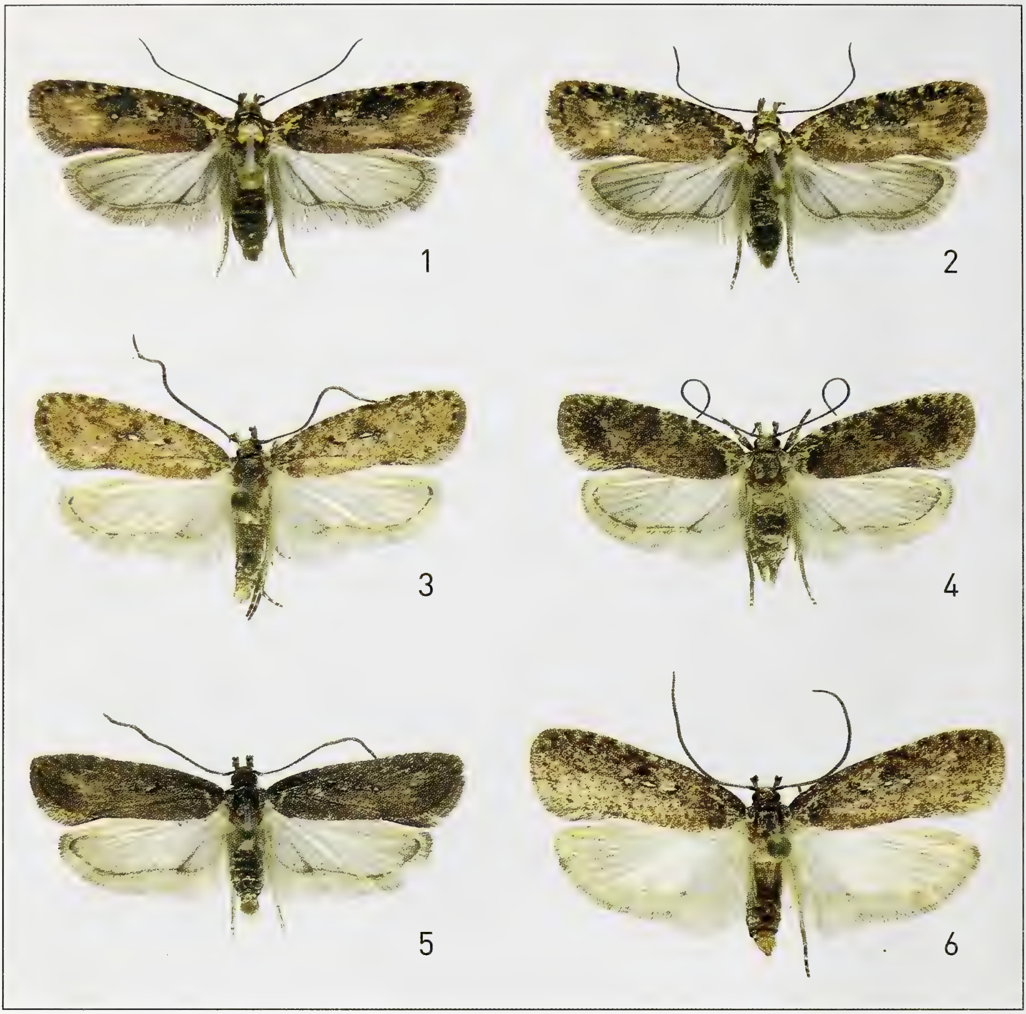
Zusammenfassung. *Agonopterix caucasiella* sp. n. wird beschrieben und mit ihren nächsten Verwandten *A. ciliella* (Stainton, 1849) und *A. heracliana* (Linnaeus, 1758) verglichen. Die Falter und die Genitalien dieser Arten werden abgebildet. Die Lebensweise von *A. caucasiella* sp. n. im Kauskaus wird beschrieben. Ihre Larven fressen an den Dolden von *Heracleum mantegazzianum* Sommier & Lévier (Apiaceae) (Riesenbärenklau), ein Neophyt in Europa, welcher für die menschliche Haut giftig ist. Die komplizierte und widersprüchliche Nomenklatur der verwandten *A. heracliana* (Linnaeus) (*Phalaena* (*Tortrix*)) wird diskutiert, genauso wie *Depressaria heracliana* (Linnaeus) sensu auctt. Für letztere ist der Name *D. radiella* (Goeze, 1783) verfügbar, während *D. heraclei* (Retzius, 1783) nicht verfügbar ist. Ein Lectotypus wird für *Pyralis applana* Fabricius, 1777 festgelegt. *Phalaena radiella* Goeze, 1783 wird als Typusart von *Depressaria* Haworth, 1811 festgelegt.

Key words. Biological control, nomenclature of Microlepidoptera, Depressariidae, *Agonopterix*, *Heracleum mantegazzianum*, Caucasus.

Introduction

Over the last century classical biological control, the use of living organisms to control pest populations, has become an increasing practice for controlling invasive weeds (Fowler & Holden 1994; Wittenberg & Cock 2001). It is hypothesized that weeds become invasive partly because they are introduced without their natural enemies (Blossey & Nötzold 1995; Keane & Crawley 2002). Released from the regulatory effect of plant diseases and insect herbivory, the plants establish themselves and proliferate rapidly in the introduced region. The strategy of classical weed biocontrol is therefore to search the native area of the plant for suitable natural enemies and introduce the biological control agents into the invaded regions.

Giant hogweed, *Heracleum mantegazzianum* Sommier & Lévier (Apiaceae), is an invasive weed in Europe and has spread rapidly during the last decades. The plant is native to the Caucasus, South-West Asia, where it occurs in forest edges and meadows,



Figs. 1–6. Adults of *Agonopterix* species. **1–2.** *A. caucasiella* sp. n. ♀, Paratypes from Russia, Caucasus, Karachay-Cherkessie Rep., Zelenchukskaya environment. **3–5.** *A. heracliana* (Linnaeus). **3, 5.** ♂, Denmark. **4.** ♀, Poland. **6.** *A. ciliella* (Stainton). ♂, Denmark.

or at stream sides in montane areas (Mandenova 1950; Tiley et al. 1996). Strikingly impressive in size and height, *H. mantegazzianum* was brought to European botanical gardens as an ornamental in the late 19th century (Pysek 1994). Due to high competitive ability and abundant seed production the plant has established in many countries of Europe, especially in Central Europe, where typical habitats are river banks, damp places and waste ground.

Once established, *H. mantegazzianum* can become the dominant vegetation forming monospecific stands which may reduce biodiversity and degrade habitat quality. Another main reason for controlling the plant is the health hazard to humans. The reaction of human skin to contact with plant sap and subsequent sun exposure causes severe blistering followed by postinflammatory hyperpigmentation (Lundström 1984; Pathak 1986). The need for sustainable solutions to stop further spread and prevent future invasions led to the initiation of the "Giant Alien" Project. This collaborative multidisciplinary project was a part of the EU 5th Framework Program with the overall objective to develop an integrated management strategy that comprises effective, practicable and sustainable means of controlling giant hogweed. Biological control may act as a component of an integrated approach to prevent the spread of the plant, and during 2002 and 2003 herbivorous insect species and fungal plant pathogens associated with *H. mantegazzianum* were sought in the area of origin in the north-western Caucasus (Seier et al. 2003; Hansen et al. 2006).

In 2003, larvae and pupae of an undescribed species of the genus *Agonopterix* Hübner, 1825 (Depressariidae) were found in the flowering umbels of *H. mantegazzianum* at a single location in the Russian Caucasus. In the following year the search for this species was intensified and several stands of *H. mantegazzianum* were investigated in the area of the first discovery. Based on observations and collections during field expeditions in 2003 and 2004 the aim of this paper is to describe the biology, morphology, systematics and nomenclature of the new species, compared with its closest relatives.

Materials and methods

Two field surveys of phytophagous insects associated with *H. mantegazzianum* were undertaken in the north-western Caucasus from 8–15 August 2003 and 23–30 July 2004. Six different populations located in the Karachay-Cherkessia Republic, Russian Federation were visited. Grid references and altitude of the locations surveyed in 2004 are listed below in Tab. 1.

The habitats included river banks, abandoned fields, mountain slopes and forest clearings and the populations each comprised at least one hundred adult individuals in a flowering or reproductive stage. In forest clearings and mountain slopes at higher altitudes (Fig. 15) the giant hogweed plants were scattered in a tall herb community, while the plants formed more dense stands in habitats such as abandoned fields (Fig. 13).

Collecting was mainly focused on the search for larvae in the flower buds and the umbels but also leaf sheaths were examined for pupae. Other plant parts such as leaves and stems were only briefly investigated. Adult moths were not observed during the surveys and no attempts were made to collect adults by light or bait trapping. Three of the six localities were also visited on a second occasion where all flower buds and umbels of randomly selected plants were registered and thoroughly examined for larvae. Umbel diameter, position, and phenology (early flower, mature flower, late flower, early seed, mature seed) were recorded and the length of larvae collected was measured. At each locality between 14 and 22 plants were examined.

The larvae and pupae were collected in plastic containers, adding fresh food when necessary. After rearing the immature stages to adult emergence in climatic chambers at room temperature the moths were identified. No larvae or pupae of other species of Lepidoptera were found during examination of the *Heracleum* plants in the Caucasus.

Abbreviations

BMNH	The Natural History Museum, London, UK
ICZN	International Commission for Zoological Nomenlature
ZIN	Zoological Institute, Academy of Sciences, St. Petersburg, Russia
ZMUC	Zoological Museum, University of Copenhagen, Denmark
‡	Unavailable name

RESULTS

Agonopterix caucasiella sp. n.

Material. Holotype: ♂, "**Russia**, Caucasus | 44°09'N, 40°04'E | Majkop, 1300 m | Lago Naki 1 | pup. 12.viii.2003 | *Heracleum mantegazzianum* | leg. C. Nielsen" "Gen. præparat No 4374♂ Agonopterix sp. H. Hendriksen." (ZIN). Paratypes (all "Russia, Caucasus, *Heracleum mantegazzianum*, leg. C. Nielsen" – for longitude/latitude of specimens from 2004 see table 1): 1♀, 44°07'N, 40°02'E, Adigeya Rep., Majkop, Lago Naki 3, 1514 m, pup. 12.viii.2003; 3♂, 43°39'N, 41°24'E; Karachay-Cherkessie Rep., Arhyz, Karacevesk, 1762 m, la. 9.viii.2003; 1♂, 2♀, Karachay-Cherkessie Rep., 8 km S Storozhevaya, 1020 m, la[rva] 24.vii.2004; 8♂, 6♀, Karachay-Cherkessie Rep., 6 km W Pregradnaya, 960 m, la[rva].25.vii.2004; 8♂, 10♀, Karachay-Cherkessie Rep., 7 km SEE Pregradnaya, 950 m, la.25.–28.vii.2004; 7♂, 6♀, Karachay-Cherkessie Rep., Zelenchukskaya env., 920 m, la. 25.–29.vii.2004; 3♂, 2♀, Karachay-Cherkessie Rep., Zelenchukskaya region, 6 km SSW Nizhnij Arkhyz, 1760 m, la. 27.vii.2004; 3♀, Karachay-Cherkessie Rep., Zelenchukskaya region, 6 km SW Nizhnij Arkhyz, 1350 m, la. 27.–28.vii.2004 (paratypes in coll. ZIN, ZMUC and C. Nielsen).

Diagnosis. The new species (Figs. 1–2) is externally very close to *A. ciliella* (Stainton, 1849) (Fig. 6) and *A. heracliana* (Linnaeus, 1758) (Figs. 3–5), differing from them in the forewing which has two distinct white spots in the middle of the cell (*A. ciliella* and *A. heracliana* have two black dots here, with only a little white admixture), and a transverse patch of lighter reddish brown between discal dot and termen. The main difference is in the structure of the male genitalia, especially in the shape of the cuiller. The new species is characterized by the noticeably curved cuiller with an oppositely curved apex (Fig. 7). *A. ciliella* and *A. heracliana* have slightly curved cuiller with the apex turned in the same direction (Figs. 8, 9).

Description. Forewing length 9–11 mm, wingspan 20–24 mm. Head yellowish white mottled with grey, frons white. Antenna grey with black transverse bars on upper surface; upperside of scape black, underside white. Second segment of labial palpus white with black scales, sometimes mottled with pink scales; apical segment white with pink shade and two black rings near base and near apex. Thorax covered with black, brown and white scales. Forewing rather dark reddish brown mixed with black scales, near the base some white scales; along the costal margin black scales alternating with pink scales; discal dot white; in the middle of the cell two white dots, the lower one being especially large and conspicuous; between these two dots and the discal dot is an additional small white dot, which is sometimes absent; fringe brownish grey; between discal dot and termen is a transverse patch of lighter reddish brown. Hindwing grey with grey fringe and darker veins. Underside of forewing dark grey with a row of pale dots along the costal and outer margins. Female similar to male.

The specimens of the type series exhibit only minor variation. Worn specimens tend to be lighter than freshly emerged ones.

Male genitalia (Figs. 7, 7a). Gnathos elongated, spindle-shaped and spinuliferous. Transtilla of uniform width. Valva narrowing to rounded apex. Cuiller (sclerotized process on the distal end of sacculus) noticeably curved towards apex of valva, with apex of cuiller curved towards the costal margin of the valva. Phallus rather short, more or less straight, with tiny cornuti.

Female genitalia (Figs. 10, 10a). Ovipositor short. Ostium close to anterior margin of sternum VIII. Apophyses anteriores two-thirds length of apophyses posteriores. Ductus bursae membranous, rather long; corpus bursae with very small, more or less oval signum.

The female genitalia are similar to those of *A. ciliella* (Figs. 11, 11a) and *A. heracliana* (Figs. 12, 12a). Small differences are found in the form of the margin of the ostium (not angular in *A. caucasiella*) and in size and form of signum. In *A. caucasiella* the signum is more or less oval, differing from the more rounded signum of *A. ciliella*. In *A. caucasiella* the signum is much smaller than in *A. heracliana*.

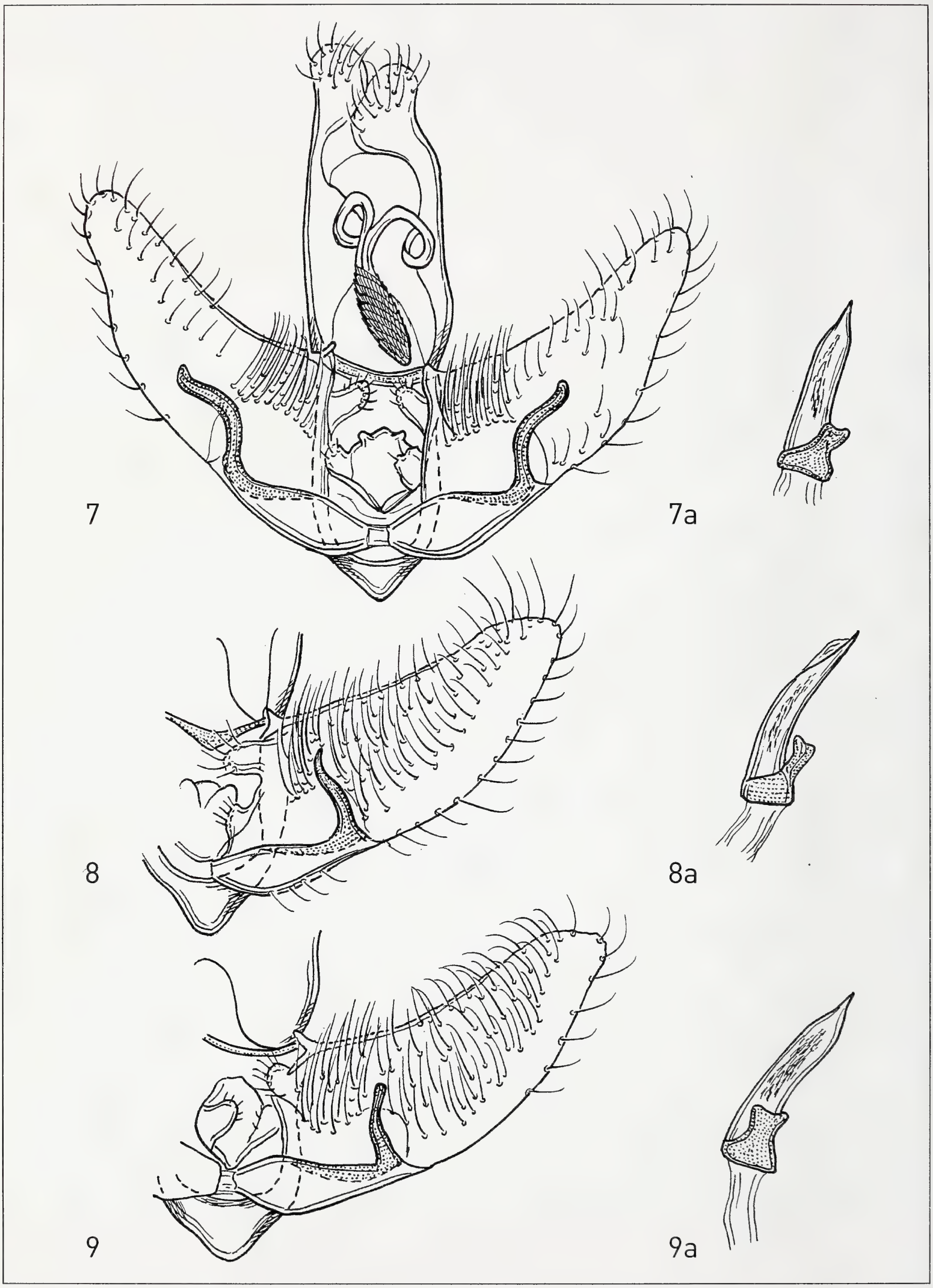
Distribution. Russia, North Caucasus: Krasnodarskiy krai and south of Stavropolskiy krai.

Life history. The length of the larvae found varied from 4 to 18 mm covering all but the very early larval instars. The larvae were rather easy to obtain by cutting down flowers and fruits of *H. mantegazzianum* in late July. Six localities were investigated in 2004 and immature stages of the moth were found at all study sites (Tab. 1). The larvae fed on buds, flowers and developing fruits within the umbels. In some cases a web was constructed around a portion of the partial umbel and the larva was feeding inside.

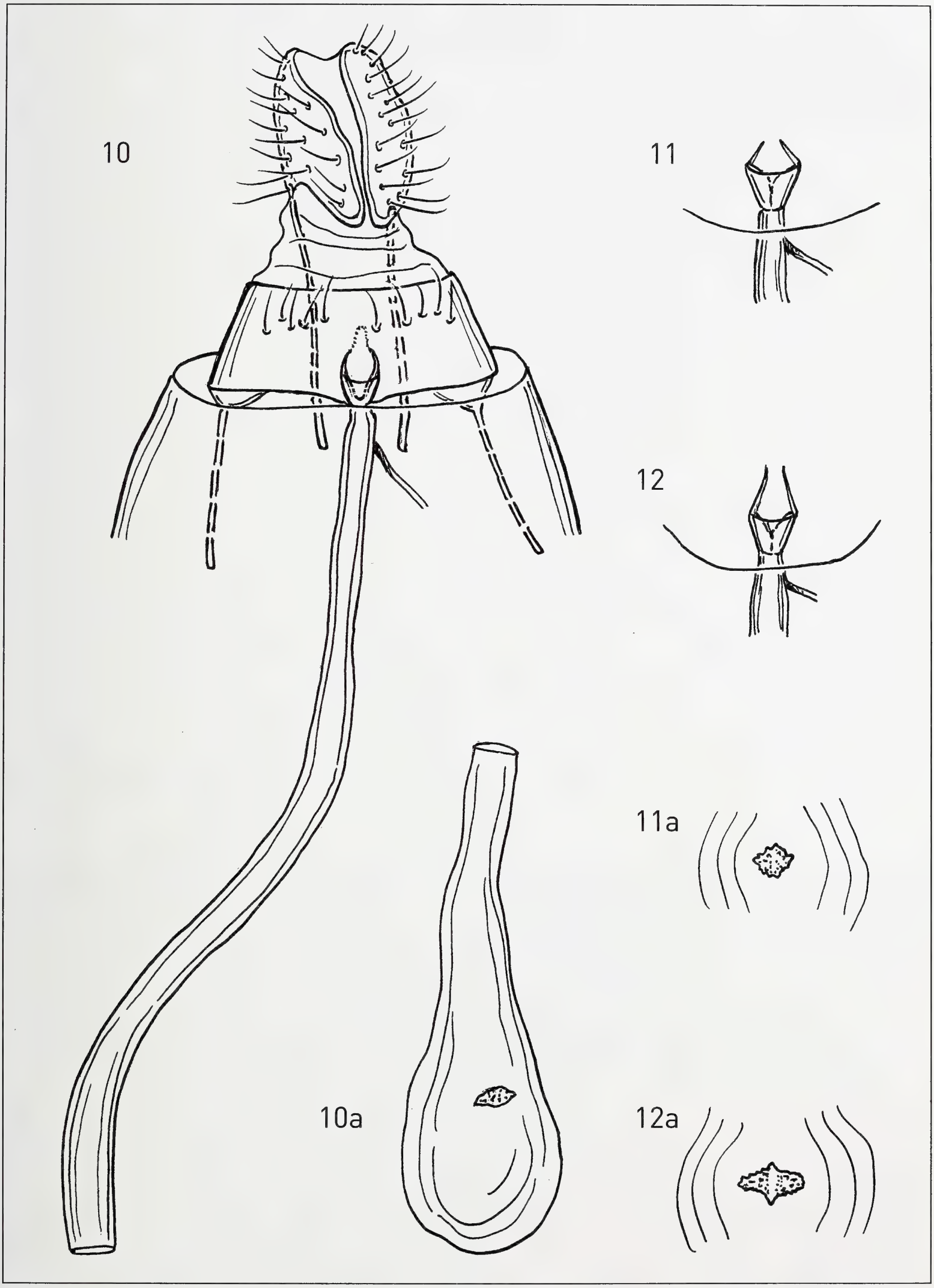
In the early larval instars the body was yellowish pale green, liberally speckled with small, but distinct blackish brown pinacula; prothoracic plate pale brown and head orange-brown. Later, as the larvae grew more than 10 mm long, the colour of the body became more green, with dorsal and subdorsal lines dark green and a pale brownish green head; thoracic and anal plates green. Near pupation the body turned reddish brown dorsally. A few pupae were located in the umbels or in the leaf sheaths. Pupation took place in late July or early August and this stage lasted about 2–4 weeks under laboratory conditions.

At the second visit to localities 3, 4, and 6 (Tab. 1) all flower buds and umbels of randomly selected plants were registered and carefully searched for larvae. In total, 724 umbels and 95 flower buds of 57 plants were examined and the collection of 47 larvae from 21 plants indicated a low density and rather clumped distribution of the larvae. The feeding larvae were found on umbels of diameters ranging from 5 to 58 cm, and larval attack was not related either to plant height or size of umbel (data not shown). However, synchrony between the development of the larvae and umbel phenology seemed evident as larval length increased with the maturation of the fruits in the umbels (Tab. 2). Host range of the larvae needs further testing before the potential of the moth as biocontrol agent against *H. mantegazzianum* is assessed.

Parasites. Two species of Hymenoptera parasites were reared from larvae of *A. caucasiella*: *Apanteles sicarius* Marshall, 1885 (Braconidae) (V. I. Tobias det.) and *Triclistus aethiops* (Gravenhorst, 1829) (Ichneumonidae) (V. I. Tolkanitz det.).



Figs. 7–9. Male genitalia. **7, 7a.** *A. caucasiella* sp. n. (7: Genitalia with phallus removed, Fig. 7a. Phallus). **Figs. 8, 8a.** *A. heracliana* (Linnaeus). **8.** Right valva, saccus, part of anellus and juxta. **8a.** Phallus. **Figs. 9, 9a.** *A. ciliella* (Stainton). **9.** Right valva, saccus, part of anellus and juxta. **9a.** Phallus.



Figs. 10–12. Female genitalia. **10, 10a.** *A. caucasiella* sp. n. (10: Proximal part of genitalia with ductus bursae; 10a: Corpus bursae with signum). **11, 11a.** *A. ciliella* (Stainton). **11.** Margin of sternum VIII with ostium, antrum and proximal part of ductus bursae. **11a.** Part of corpus bursae with signum. **Figs. 12, 12a.** *A. heracliana* (Linnaeus). **12.** Margin of sternum VIII with ostium, antrum and proximal part of ductus bursae. **12a.** Part of corpus bursae with signum.

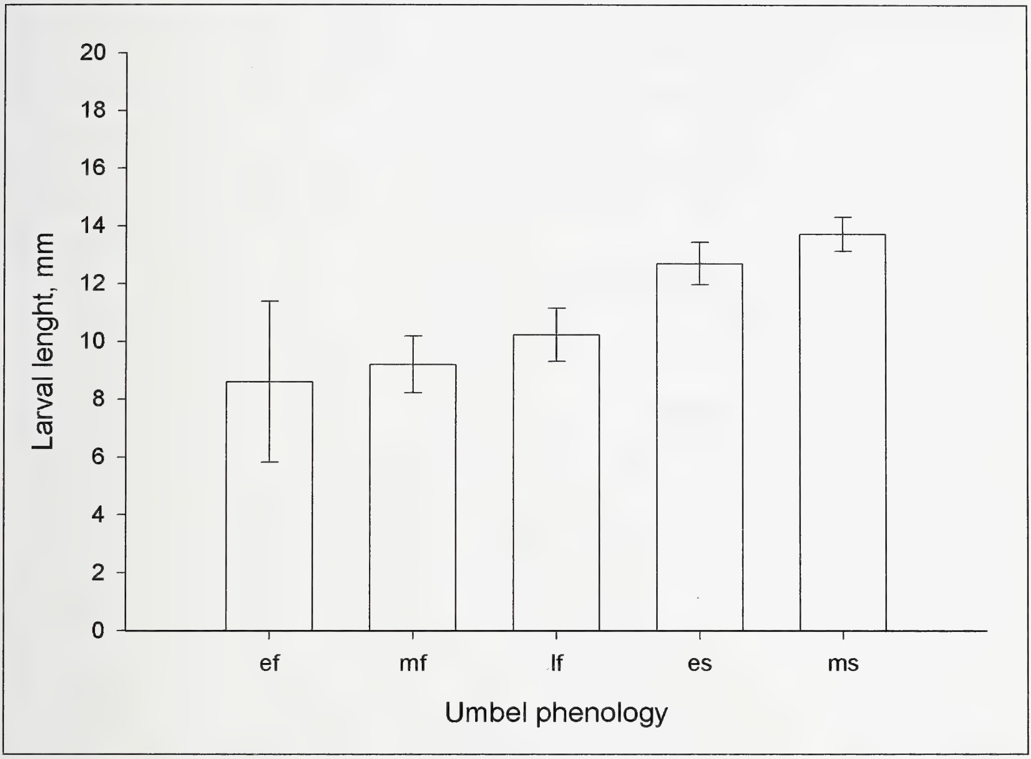
Tab. 1. Description of localities sampled in 2003 and 2004 in the Karachay-Cherkessia Republic, Russia and the number of collected larvae and emerged adults of *A. caucasiella*.

Locality no.	Administrative description	Grid reference	Altitude	Description of locality	Plant development stage	Date	No of collected larvae and pupae	No of emerged adults
1	8 km S Storozhevaya	N43°49'07.6" E41° 7'35.3"	1020 m	abandoned field	Late flowering, reproductive	24.vii.	4	3
2	6 km W Pregradnaya	N43°57'02.9" E41° 6'02.3"	960 m	road side / abandoned field	Late flowering	25.vii.	11	5
3	7 km SEE Pregradnaya	N43°54'45.7" E41° 7'02.8"	950 m	abandoned field	Late flowering, reproductive	25.–28.vii.	24 19	13
4	Zelenchukskaya env.	N43°53'10.0" E41° 2'23.8"	920 m	abandoned field / river bank	Reproductive	25.–29.vii.	27 7	15
5	6 km SSW Nizhnij Arkhyz, Zelenchukskaya region	N43°39'28.1" E41° 4'99.3"	1760 m	hill slope	Early flowering	(9.vii. 2003) 27.vii.	(3) 6	(3) 2
6	6 km SW Nizhnij Arkhyz, Zelenchukskaya region	N43°39'22.3" E41° 3'30.5"	1350 m	forest clearing / hill slope	Mature flowering, early reproductive	27.–28.vii.	15 21	18

Remarks. *Agonopterix caucasiella* sp. n. is closely related to *A. ciliella* (Stainton) and *A. heracliana* (Linnaeus). The nomenclature of the latter is unusually complicated and confusing and we therefore find it appropriate, in connection with the description of a new species feeding on *Heracleum*, to discuss it in some detail. Another related species is the North American *A. clemensella* (Chambers, 1876), which also uses *H. mantegazzianum* as a host plant (Berenbaum 1982; Robinson et al. 2005), but it differs in details of the genitalia of both sexes (Clarke 1941).

***Agonopterix heracliana* (Linnaeus, 1758: 532) (*Phalaena* (*Tortrix*))**
[*Phalaena*] *punctata* Clerck, 1759: pl. 2, fig. 15.
‡*Phalaena* (*Tortrix*) *heracleana* Linnaeus, 1761: 347.
Pyralis applana Fabricius, 1777: 294.
‡*Phalaena cerefolii* Retzius, 1783: 45.
‡*Phalaena heraclei* Retzius, 1783: 45.
Tinea heraclella Fabricius, 1798: 484.
Tinea applanella Fabricius, 1798: 484.
Tinea cicutella Hübner, 1796: 39, pl. 12, fig. 79.
Depressaria heraclei Haworth, 1811: 505.
Depressaria heracliella Doubleday, 1859: 29.

Tab. 2. Average larva length (± S.E.) in relation to umbel phenology (ef = early flower, mf = mature flower, lf = late flower, es = early seeds, ms = mature seeds), n = 45. Two larvae found in the flower buds are not included in the figure.



Phalaena (*Tortrix*) *heracliana* was based on an unstated number of specimens. The type locality was (indirectly) given as Sweden (see also (Linnaeus, 1761)). It was stated that it occurred in umbels of *Heracleum.* In addition to his diagnosis of *heracliana* Linnaeus also gave references to figures in the works of De Geer (1752: pl. 29 figs. 6–7) and Réaumur (1736: pl. 16 figs. 1–4). Those by De Geer are of the species with larva feeding in rolled leaves of (e.g.) *Anthriscus sylvestris*, viz. *Agonopterix heracliana*, while those of Réaumur show a larva feeding in the umbels of a species of Apiaceae (*Depressaria radiella*). In Linnaeus' collection Robinson & Nielsen (1983: 215) found five specimens representing both of the above mentioned species.

Before them Bradley (1966) had studied the material in Linnaeus' collection, recognizing only two specimens, both belonging to the *Agonopterix* species, and designated one of them as the lectotype. By this action he fixed the name *heracliana* to the *Agonopterix* species. This was a most inappropriate action because the stability of nomenclature for the involved species became upset by: 1) the specific name *heracliana* was moved from being the valid name for one well known species (in *Depressaria*) to becoming the valid name of another well known species (in *Agonopterix*), 2) the long established name *applana* (Fabricus) was sunk as a synonym, 3) the long established name *heracliana* (in the combination *Depressaria heracliana* (Linnaeus)) was replaced by a name, *D. pastinacella* (Duponchel), which turned out not to be the oldest name for the species, and 4) *Phalaena heracliana* (Linnaeus) is the type species of the genus *Depressaria* Haworth, 1811 (Nye & Fletcher 1991: 91), and the lectotype designation by Bradley (1966) resulted in a case with a genus having a misidentified type species. Under the previous code such a case should have been referred to the ICZN, but that did not happen.

There would probably have been a good case for asking the ICZN to preserve the name *Phalaena heracliana* (Linnaeus) for the *Depressaria* species. Now, nearly 40 years later, this possibility is probably lost, because the use of *heracliana* in *Agonopterix* has been broadly accepted, and a return to its former use within *Depressaria* would cause additional confusion.

Phalaena punctata was based on a figure published by Clerck (1759). According to Robinson & Nielsen (1983: 224) there is no material of *P. punctata* in Clerck´s collection, and it is likely that Clerck figured a specimen from Linnaeus´ collection.

Phalaena (*Tortrix*) *heracleana* is an incorrect subsequent spelling (misspelling) of *P.* (*T.*) *heracliana* Linnaeus, 1758 (Robinson & Nielsen 1983: 215).

Pyralis applana was described from an unspecified number of specimens collected by Sehested in Kiel, Germany (Fabricius 1777). In Fabricius´ collection in ZMUC are three specimens, all in rather poor condition, but clearly referable to *applana*, one of them labelled “applana” in Fabricius´ handwriting. In the Sehested & Tønder Lund collection in ZMUC is a male, unset but in good condition. Seen in the light of the nomenclatorial confusion around the name *applana* it seems justifiable to designate the last mentioned male as the lectotype. It is labelled: “Mus. Seh. & T. L. | T. applanella | Lectotype, Pyralis applana Fabricius, 1775, O. Karsholt design., 2005”. The three specimens in Fabricius´ collection are labelled as paralectotypes.

Retzius diagnosed and named insects described by De Geer (1752) without using the Principle of Binominal Nomenclature (ICZN 1999, article 5). However, the work by Retzius (1783) was not consistent in application of binominal nomenclature, and therefore it does not meet the demands of the Code (ICZN, 1999: article 11.4) and the names published therein are invalid under the Code. We are aware that names proposed by Retzius (1783) are used as valid for several species of Lepidoptera, and also for species of other insect groups, but a discussion of this problem falls outside the present study.

Retzius was aware that Linneaus (1758) had mixed two species under *Ph. heracliana*, viz. the one figured by Réaumur (1736) and the one figured by De Geer (1752). For the latter which, as stated above, is the *Agonopterix* species, he proposed the name *Ph. cerefolii*.

The other species (the one figured by Réaumur) is, according to Retzius (1783) and in agreement with most later authors, the real *Ph.* (*T.*) *heracliana* (Linnaeus), which was later placed in the genus *Depressaria*. Linnaeus had placed this species in his “subgenus” *Tortrix* and had, accordingly given it a name ending in *–ana*. Retzius did not use *Tortrix*, but placed most moths in the genus *Phalaena*, and emended its name to *heraclei*. Although being an emendation under the present Code, it should be noted that at the time of Retzius a change of termination of species-group names was customary when changing the generic combination used. Being an emendation of *Ph.* (*T.*) *heracliana* Linnaeus the type of *Ph. heraclei* Retzius is the same as that of *Ph.* (*T.*) *heracliana*. Due to the unfortunate lectotype designation of *Ph.* (*T.*) *heracliana* Linnaeus by Bradley (1966) (see above) *Ph. heraclei* moreover becomes a misidentification, since Retzius described the *Depressaria* species, but used his emended name of *heracliana*, which since 1966 belongs to the *Agonopterix*. Besides being both an emendation and a misidentification (of *Ph.* (*T.*) *heracliana* Linnaeus) *Ph. heraclei* is moreover invalid under the Code.

Tinea heraclella is both a misidentification and an unjustified emendation of *Phalaena* (*Tortrix*) *heracliana* Linnaeus, Fabricius (1798) clearly referred to *Phalaena heracleana* [sic!] Linnaeus, but none of the three specimens in his collection are conspecific with the lectoptype of *Ph.* (*T.*) *heracliana* Linnaeus designated by Bradley (1966). However, being an emendation, the type of *T. heraclella* is the same as that of *Ph.* (*T.*) *heracliana*, which belongs to the *Agonopterix* species. As discussed above, at the time of Fabricius the change of termination in a species name had to follow the change in generic combination.

Tinea applanella is an emendation, which was made by Fabricius (1798) when transferring *applana* from the genus *Pyralis* to the genus *Tinea*.

Tinea cicutella was described from an unstated number of specimens from Augsburg in Germany ["Sie ist hier ...anzutreffen" (Hübner, 1796: 39)].

Depressaria heraclei Haworth is an emendation of *Phalaena* (*Tortrix*) *heracliana* Linnaeus, thus being an objective synonym of the latter. It is also a misidentification, as Haworth under the name of *D. heraclei* described *Depressaria radiella* (Goeze), and it is a homonym of *Ph. heraclei* Retzius.

Depressaria heracliella Doubleday is an unjustified emendation of *Phalaena* (*Tortrix*) *heracliana* Linnaeus (cited as 'heracliana, 'De Geer", and it is, after the lectotype designation by Bradley (1966) a misidentification of *Depressaria radiella* (Goeze).

It adds to the confusion of the involved species that *Heracleum* is not a main host plant for *A. heracliana* (Zeller, 1854: 203).

***Depressaria radiella* (Goeze, 1783: 162) (*Phalaena* (*Tinea*))**
Tinea radiata Geoffroy *in* Fourcroy: 1785: 320.
Haemilis pastinacella Duponchel, 1838: 153, pl. 291 figs. 4–5.
Depressaria sphondiliella Bruand d'Uzelle, 1851: 73.
Depressaria ontariella Bethune, 1870: 3.
Depressaria caucasica Christoph, 1877: 293.
Depressaria heracliana auct.; misidentification.
‡*Depressaria heraclei* (Retzius); misidentification.

This species was for more than 200 years known as *Depressaria heracliana* (Linnaeus). Due to the lectotype designation of *Ph.* (T.) *heracliana* Linnaeus by Bradley (1966) it had to change name, and Bradley suggested the oldest synonym known to him, *Haemilis pastinacella* Duponchel. Over the next decades this name came slowly into use.

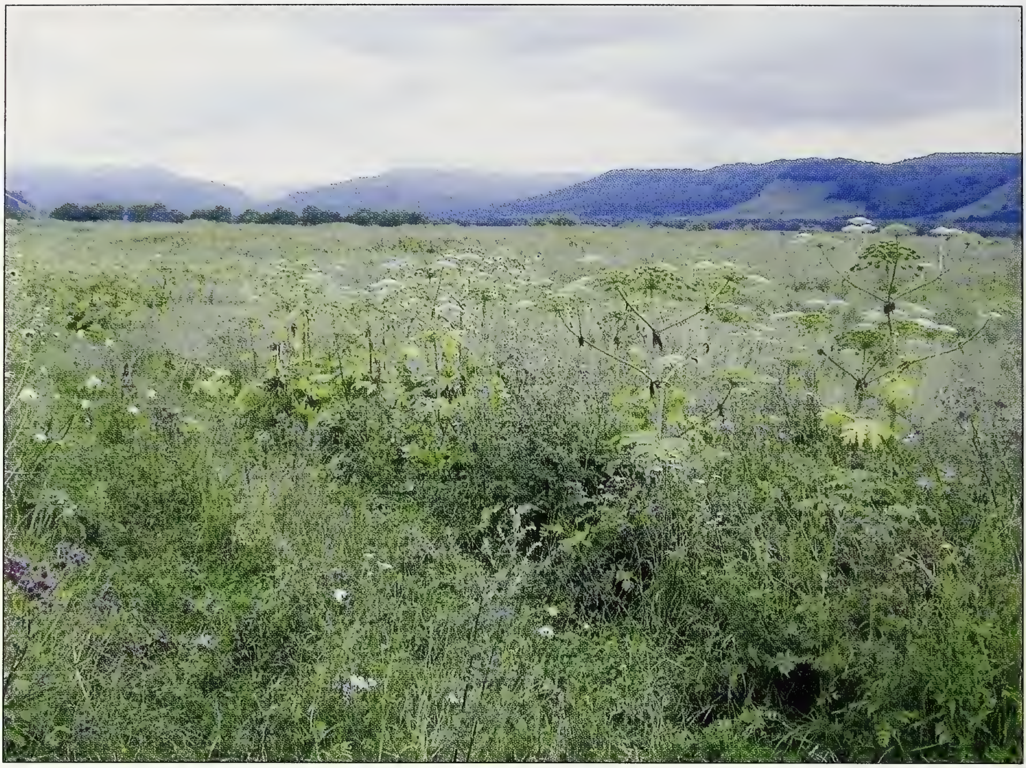


Fig. 13. *Heracleum mantegazzianum* in the native area of western Caucasus. The stand is located in an abandoned field (locality 1), altitude: ca. 1020 m.

However, in the second edition of the French checklist, Leraut (1997) listed three older synonyms (two of which are accepted here). In a comment Leraut (1997: 314) stated that he considered *Depressaria heraclei* (Retzius) as the oldest name for this species, referring to "Leraut, *in prep*.". Now eight years later no details of this synonymy has been published and, as discussed above, *Ph. heraclei* Retzius is an emendation of *Ph.* (T.) *heracliana* Linnaeus, and therefore an objective synonym.

Goeze (1783) named a number of taxa, which had been described by Geoffroy (1762) without using the Principle of Binominal Nomenclature (ICZN 1999, article 5). *Phalaena* (*Tinea*) *radiella* is one of them. The type locality is the area of Paris.

The works of Goeze and Retzius were both published in 1783. We have no information on more exact dates for their publication but we suggest, seen in the light of the doubtfulness on the validity of the names proposed in Retzius´ work, that whenever it becomes relevant the work of Goeze should pre-date that of Retzius.

Also Fourcroy (1785) gave Latin names to taxa described by Geoffroy. However, for the species already named by Goeze (1783) the names of Fourcroy, as in this case, became objective synonyms. There has been a great deal of confusion as to whether Fourcroy or Geoffroy should be cited as the author of these names, but a discussion of this falls outside the present study.

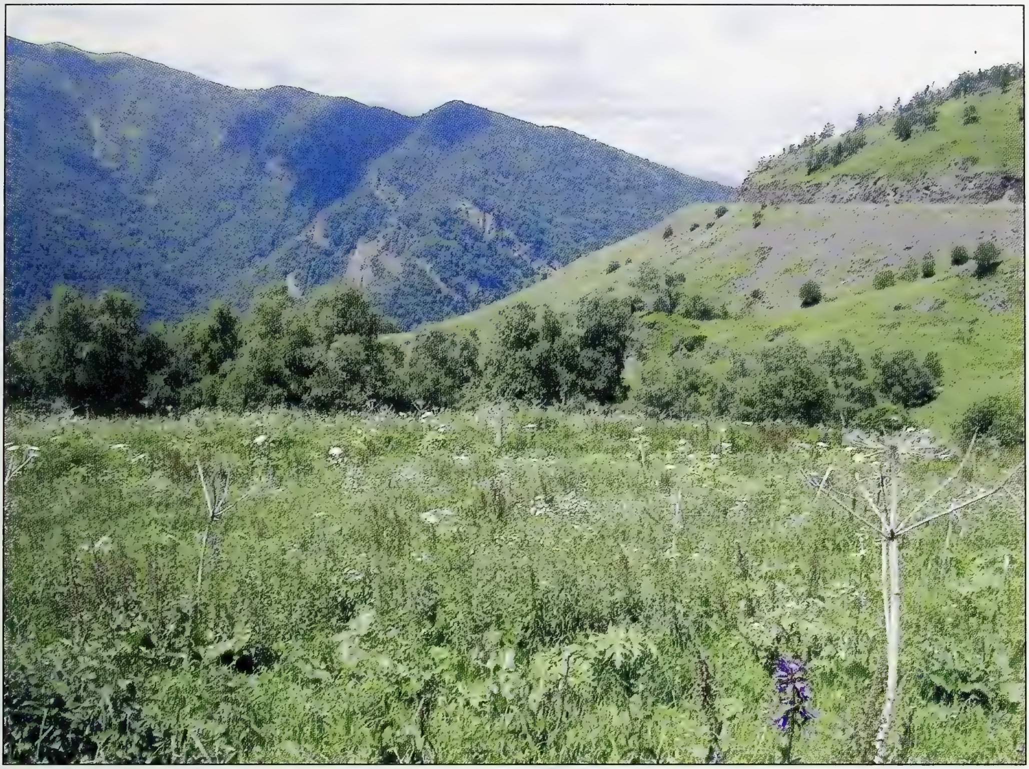


Fig. 14. A population of *H. mantegazzianum* growing on a hill slope (locality 5), altitude 1760 m. In western Caucausus stands of *H. mantegazzianum* were found in altitudes up to approximately 2000 m.

Haemilis pastinacella was described from an unstated number of specimens from Austria, Bohemia and France. According to Zeller (1854) they included at least two different species. A lectotype was published by Bradley (1966: 226).

Depressaria sphondiliella Bruand d'Uzelle is an unneccessary replacement name for *Depressaria pastinacella* (Duponchel).

Depressaria caucasica was described from an unstated number of specimens (2 males and 1 female are deposited in the BMNH) collected by Christoph in southern Daghestan in Caucasus. It is considered as a highland form of *D. pastinacella* (Duponchel) (Lvovsky 1998).

Depressaria ontariella was described from an unstated number of specimens bred from parsnip (*Pastinaca*) in Ontario, Canada.

As discussed above, the lectotype of *Ph.* (*T.*) *heracliana* belongs to the *Agonopterix* species (Bradley 1966), and all uses of the name *heracliana*, and its emendations *heraclei*, *heraclella* and *heracliella* for the *Depressaria* species thereby become misidentifications. Further variations in spelling of the species-group name *heracliana* are found in the literature, but all are misspellings and thus invalid.

As mentioned above *Phalaena* (*Tortrix*) *heracliana* is the type species of the genus *Depressaria* (Nye & Fletcher 1991: 91), and the lectotype designation by Bradley

(1966) resulted in a case of a misidentified type species of this genus. Under previous editions of the Code such cases of misidentification had to be referred to the ICZN, but that was not done. Under the present code (ICZN 1999, article 70.3) it is left to authors who discover cases of misidentification to correct these in the way that best serves stability. We accordingly select, and thereby fix as type species for the genus *Depressaria* Haworth, 1811, *Phalaena radiella* Goeze, 1783 (= *Phalaena* (*Tortrix*) *heracliana* auct., nec Linnaeus, 1758).

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Adela alurgis sp. n. from Syria (Adelidae)

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Abstract. *Adela alurgis* sp. n., described from specimens collected in Syria, is closely related to *A. violella* ([Denis & Schiffermüller], 1775) from which it differs by the purplish colour of the distal part of the forewing, the blackish head, and the silver-grey distal part of the antenna. The male of *A. alurgis* has a hook-like medial protuberance at the base of the valva, a shorter vinculum (<2.1× length of valva), a narrower distal part of the valva, and a thick phallus (length to medial diameter ratio around 15).

Key words. *Adela*, Adelidae, taxonomy, Syria.

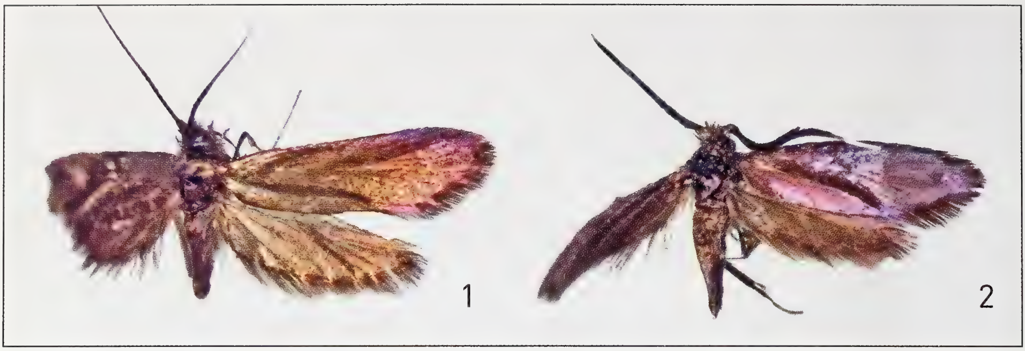
Introduction

The fairy moth genus *Adela* Latreille, 1796 is clearly defined by the presence of hook-shaped, outwardly directed antennal pegs considered an autapomorphy (Nielsen 1980). Nearctic species of *Adela* have been revised by Powell (1969), while the identities of the East Palaearctic species were examined by Kozlov (1997) and Hirowatari (1997). To date, the European fauna is believed to include 11 species (Karsholt & van Nieukerken 2005), with none reported from Syria (Stainton 1867, van Nieukerken 2005). The nomenclature of some of the European species is debatable, and applications have been made to the International Commission of Zoological Nomenclature to insure the stability of several scientific names including *A. australis* (Kozlov & van Nieukerken 2003) and *A. croesella* (Kozlov 2006).

In the early 1990s, while surveying materials of the Natural History Museum (London), I discovered four specimens labelled by Walsingham as types of *A. alurgis*. This was a manuscript name and for a long time I hesitated to formally describe this species because of its close affinity to *A. violella* ([Denis & Schiffermüller], 1775). However, my investigations of dozens of *A. violella* specimens convinced me that differences between *A. alurgis* and *A. violella* exceed the 'normal' range of geographical variation. In this paper I take the risk of introducing this new name in isolation from my comprehensive taxonomic revision of the genus *Adela* that is in progress now, but that won't be completed within the next few years.

Adela alurgis sp. n. (Figs. 1–7)

Material. Holotype ♂: **Syria**, near Aleppo; labelled: 8 mm circle with red border, print 'Holo- | type'; 8 × 15 mm, print 'Shar Devesy | HALEB [=Aleppo] | 1893 | (Nat. Coll.) Leech'; 8 × 10 mm, print 'Walsingham | Collection | 1910-427'; 8 × 18 mm, black frame, black ink + print 'Adela | alurgis | Type ♂ W | Named by Wlsm.'; 9 × 16 mm, print 'B. M. | Genitalia slide | No. 29995'; 6 × 18 mm, print 'HOLOTYPE ♂ | *Adela* | *alurgis* Kozlov'. Paratypes: 1♀, labelled: 8 mm circle with yellow border, print 'Para- | type'; 8 × 15 mm, print 'Shar Devesy | HALEB [=Aleppo] | 1893 | (Nat. Coll.) Leech'; 8 × 10 mm, print 'Walsingham | Collection | 1910-427'; 8 × 18 mm, black frame, black ink + print 'Adela | alurgis | Type ♀ W | Named by Wlsm.'; 6 × 18 mm, print 'PARATYPE ♀ | *Adela* | *alurgis* Kozlov'. 2♀, labelled: 8 mm circle with yellow border, print 'Para- | type'; 8 × 15 mm, print + black ink 'Shar Devesy | HALEB [=Aleppo] | 1893 | (Nat. Coll.) Leech | 61350 [or 61351]'; 8 × 10 mm, print 'Walsingham | Collection | 1910-427'; 6 × 18 mm, print 'PARATYPE ♀ | *Adela* | *alurgis* Kozlov'. The type specimens are deposited in the Natural History Museum, London.

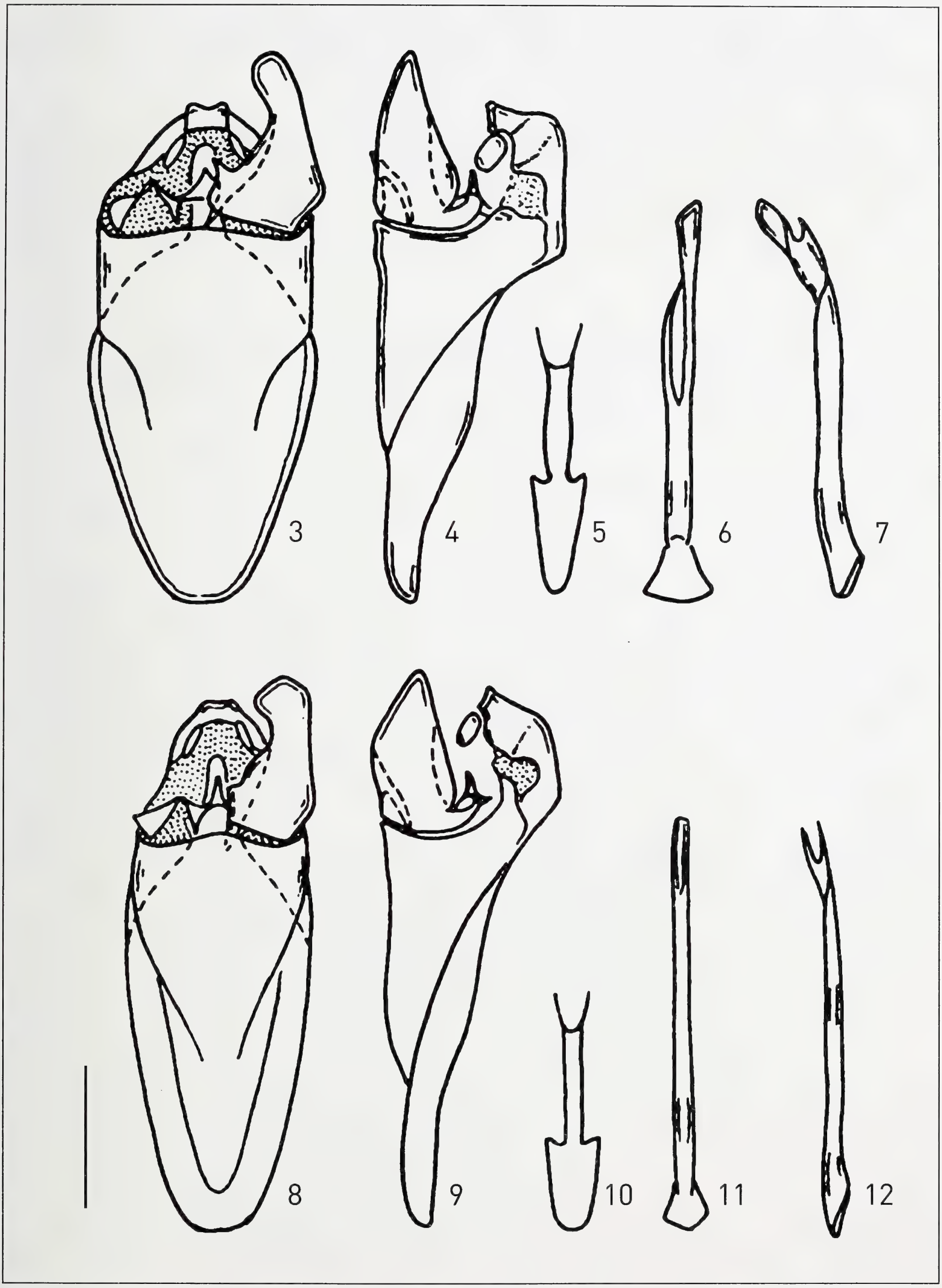


Figs. 1–2. *Adela alurgis*. **1.** Male holotype. **2.** Female paratype.

Diagnosis. Closest to *A. violella*, from which it differs by the purplish colour of the distal part of the forewing, the blackish head, the silver-grey distal part of the antenna, the presence of a hook-like medial protuberance at the base of the valva, the shorter vinculum (< 2.1 × length of valva), the narrower distal part of the valva (compare figs. 3–4 and 8–9), and the thick phallus (length to medial diameter ratio around 15; compare figs. 6–7 and 11–12).

Description. Male (Fig. 1). Forewing length 5.6 mm, width / length ratio 0.30. Vertex blackish, with sparse yellow scales; frons light glossy golden. Labial palpus 1.7 × vertical eye diameter, light brown, with blackish raised piliform scales. Proboscis light brown, base with bronze scales. Eyes not enlarged; interocular index 0.6. Antenna > 2 × forewing length (tip broken). Scape and base of flagellum (up to 0.7 × forewing length) dark bronze, then colour gradually changing to silver-white. Tegulae and thorax dark bronze. Forewing dark bronze basally to purplish bronze apically; cilia purplish to bronze. Hindwing coppery brown; costal area grey; cilia bronze to light brown. Legs from bronze to light yellowish brown. Epiphysis at 0.5, not reaching apex of tibia. Abdomen dorsally dark brown with bronze lustre, ventrally light greyish bronze.

Male genitalia (Figs. 3–7). Tegumen dome-shaped, without medial ridge. Socii oval, 1.0–1.2 × diameter of phallus. Vinculum 2.0 × length of valva (2.2–2.5 in *A. violella*), wide (seen from ventral side: length / width ratio 1.75, compared to 2.0–2.2 in *A. violella*) with slightly convex lateral margins; distal margin nearly straight (shallowly W-shaped in *A. violella*; compare figs. 3 and 8). Valva extending far beyond tip of tegumen; ventral margin with deep indentation; base with hook-like medial protuberance; dorsal margin slightly convex; tip nearly rectangular, narrow (seen from ventral side: distal part of valva 1.5 × medial diameter of phallus, compared to 3–4 in *A. violella*). Anellus 0.35 × length of valva. Transtilla with short triangular medial process. Juxta 0.6 × length of phallus, arrow head narrow (width / length ratio 0.45), with rounded tip and short lateral arms. Phallus nearly equal to length of vinculum, almost straight, relatively thick (length to medial diameter ratio around 15, compared to 30 in *A. violella*); distal 0.25 with right wall developed into lobe; with small hook-like process in middle of dorsal side; base of phallus widely funnel-shaped.



Figs. 3–12. *Adela alurgis*, male genitalia. **3.** Genital complex, ventral view (right valva not shown). **4.** Genital complex, lateral view. **5.** Juxta. **6.** Phallus, ventral view. **7.** Phallus, lateral view.
Figs. 8–12. *Adela violella*, male genitalia. **8.** Genital complex, ventral view (right valva not shown). **9.** Genital complex, lateral view. **10.** Juxta. **11.** Phallus, ventral view. **12.** Phallus, lateral view.

Female (Fig. 2). Forewing length 5.1–5.2; antenna 1.3–1.4 × forewing length; basal 0.35–0.45 of flagellum thickened by coppery black scales; distal part of flagellum silvery white. Otherwise similar to male.

Remark. Sattler (1979: 286) mentioned that the correct spelling of the geographical name is 'Shar Deresy', and that it may actually belong to Turkey, not Syria. I was unable to clarify the exact position of the type locality.

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Pasiphila hyrcanica sp. n. (Geometridae, Larentiinae) – a new species from Azerbaijan and Iran

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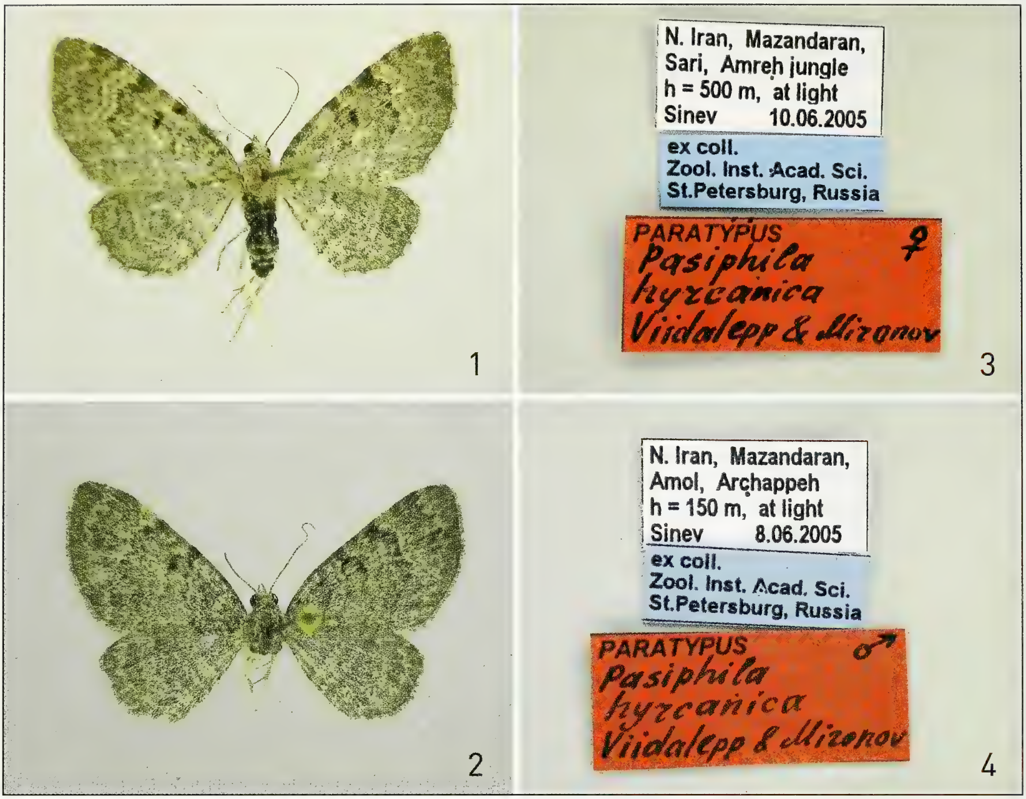
Abstract. A description of a new geometrid moth, *Pasiphila hyrcanica* Viidalepp & Mironov, sp. n. (Geometridae, Larentiinae), from south-eastern Azerbaijan (Talysh Mts.) and northern Iran (foothills of the Elburz mountains) is given. The holotype and some paratypes of the new taxon from Azerbaijan are kept in the collection of the Institute of Agriculture and Environment, Estonian Agricultural University Tartu (IAET), while other paratypes from Azerbaijan and Iran are kept in the collections of the Zoological Institute of the Russian Academy of Sciences, Saint Petersburg, Russia (ZISP), of the Estonian Natural History Museum (NHMT) and in the private collection of T. Marnot, Tallinn.

Key words. Lepidoptera, Geometridae, *Pasiphila hyrcanica*, new species, Azerbaijan, Iran.

Introduction

The tribe Eupitheciini includes at least 39 genera and more than 1.700 species distributed worldwide. Of these, four genera and 133 species have been recorded from Europe (Mironov 2003). They are small, often greyish or brownish moths and their larvae feed on flowers and seeds rather than on leaves. Species belonging to the genus *Pasiphila* are characterized by having the forewing vein R_1 short and almost completely united with Sc and a short accessory cell without transverse vein. Their male genitalia, are characterized by the vesica of the phallus bearing two apical horn-like cornuti and numerous minute spines. The Catalogue of the Geometridae of the World (Scoble et al. 1999) includes 36 species of the genus *Pasiphila*. The majority of them, at least 27 species, are distributed in New Zealand and only 8 species are presently known from the Palaearctic Region. Holloway (1997) discussed the diagnostic characters of *Pasiphila* Meyrick, 1883 and of the related taxa *Gymnodisca* Warren, 1894 and *Rhinoprora* Warren, 1894, considering the Indo-Australian fauna. He stressed the different conformation of male antennae, that are fasciculate in *Pasiphila* and filiform in *Gymnodisca* (= *Rhinoprora*), and combined ten Bornean and Indo-Australian species under the subgenus *Gymnodisca* of *Pasiphila*. In this article we describe one new species, *Pasiphila* (*Gymnodisca*) *hyrcanica* Viidalepp & Mironov, sp. n., from the territory of Azerbaijan and Iran. The species was mentioned earlier as *Rhinoprora talyshensis* (nom. nud.) in the list of species of the tribe *Eupitheciini* of the U.S.S.R. (Mironov 1990) and in the checklist of Geometridae of the former U.S.S.R. (Viidalepp 1996).



N. Iran, Mazandaran,
Sari, Amreh jungle
h = 500 m, at light
Sinev 10.06.2005

ex coll.
Zool. Inst. Acad. Sci.
St.Petersburg, Russia

PARATYPUS ♀
Pasiphila
hyrcanica
Viidalepp & Mironov

N. Iran, Mazandaran,
Amol, Archappeh
h = 150 m, at light
Sinev 8.06.2005

ex coll.
Zool. Inst. Acad. Sci.
St.Petersburg, Russia

PARATYPUS ♂
Pasiphila
hyrcanica
Viidalepp & Mironov

Figs. 1–4. *Pasiphila hyrcanica* sp. n. **1.** Paratype ♀, N. Iran, Sari, ZISP. **2.** Paratype ♂, N. Iran, Amol, ZISP. **3.** Labels of paratype ♀, N. Iran, Sari. **4.** Labels of paratype ♂, N. Iran, Amol.

Pasiphila hyrcanica Viidalepp & Mironov, sp. n.

Material. Holotype ♂. [**Azerbaijan**] Talysh Mts. 20.vi.1984 | Dasdatuk leg. Marnot (coll. IAET). – Paratypes: ♂ Talysh, leg. Prasolov (coll. IAET); 5♂, 7♀ Talysh, 20.–29.vi.1984, Dashdatyuk, leg. Marnot & Lindt (slides nos 1759, 3191) (coll. IAET, Marnot and Lindt); 1♂, 4♀ Talysh, 17.–26.vi.1984, Lerik, leg. Jürivete, Lindt (coll. IAET, NHMT); 1♀ Talysh, 30.vi.1984, Alekseevka [village] leg. Lindt, (coll. NHMT); 1♀ Talysh (Mts.), Hyrcansky Forest, Alekseevka vill., on the glade at day, 13.v.1964, leg. Zaguljaev (ZISP); 1♀ Lenkoran, Avrora vill., Hyrcansky Forest, forest zone, at light, 23.v.1964, leg. Zaguljaev (ZISP); 1♂, N. **Iran**, Mazandaran, Amol, Archappeh, 150 m, at light, 8.vi.2005, leg. Sinev, (ZISP); 6♀ Mazandaran, Sari, Amreh jungle, 500 m, at light, leg. Sinev, 10.vi.2005 (ZISP). 2♀ Iran, prov. Mazandarăn, 1 km E of Razan, 1190 m, 9.v.2000, leg. Szabó & Hentschel (coll. Sommerer, Munich).

Description. (Figs. 1–4). Wingspan 16–19 mm; length of forewing 8–10 mm. Labial palpi elongate and narrow, lanceolate-oblong, about 1.5 times longer than diameter of eye, pale grey irrorated by black scales. Frons, vertex and nothum pale grey or grey. Forewing broad with slightly arched costa, evenly curved terminal margin and more or less obtuse apex; ground colour grey; transverse lines blackish grey; antemedial line evenly curved; medial line dentated, inconspicuous; postmedial line angled twice between costa and M3 (as in *P. rectangulata* (Linnaeus, 1758), but less prominent than in this species); terminal area slightly darker with inconspicuous whitish subterminal line; terminal line narrow, blackish; discal dot distinct, intensely black, obliquely ovoid.

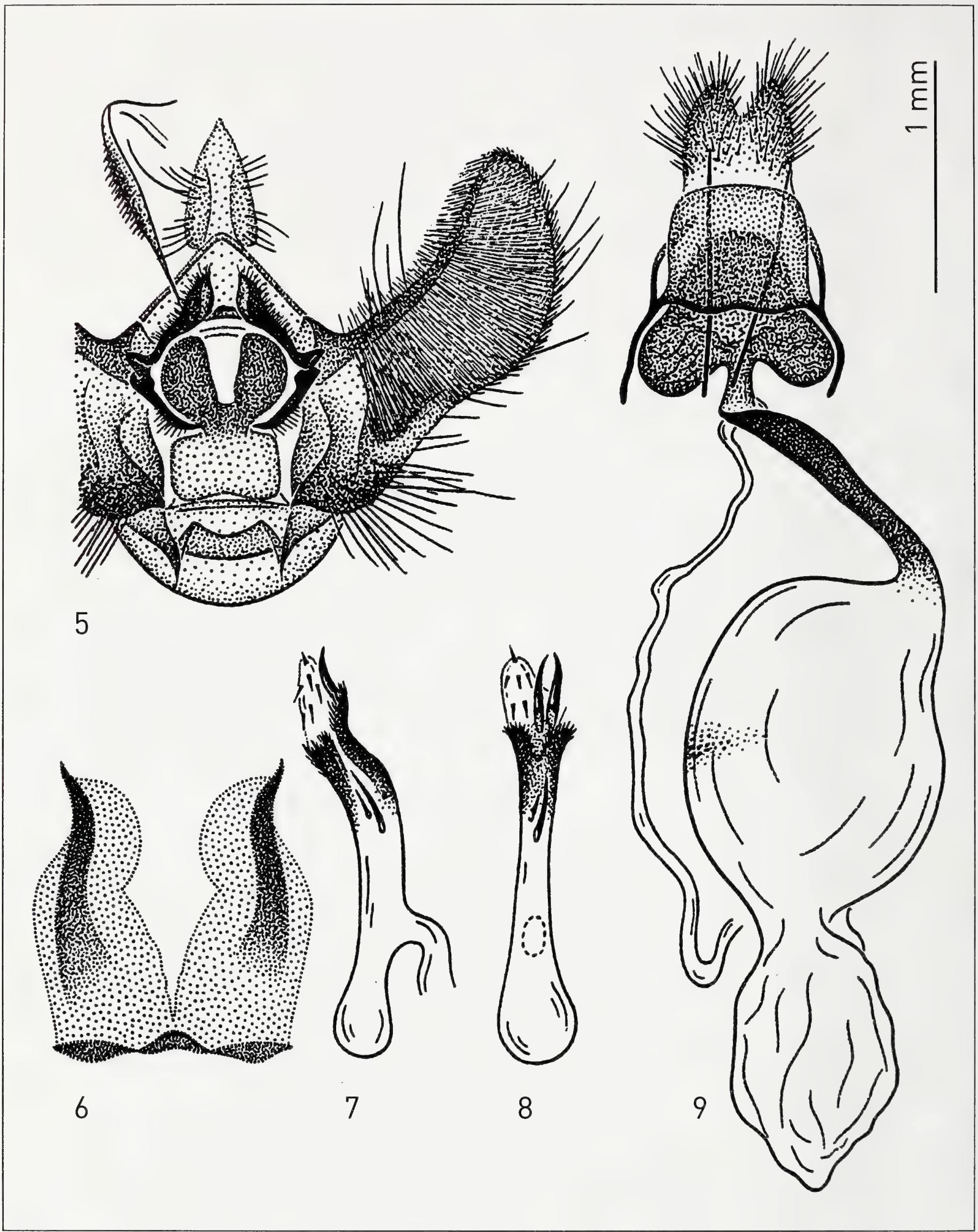
Fringe short, slightly chequered pale and dark grey. Hindwing of the same colour of the forewing, with indistinct transverse lines; postmedial line forming an angle near M3 vein; terminal area usually slightly darker, with very inconspicuous pale subterminal line; discal dot small, pale, rounded or ovoid, sometimes indistinct; terminal line and fringes as in forewing. Underside of wings paler than upperside; pattern similar to the upperside but inconspicuous, with the exception of the postmedial lines and discal dots on both fore- and hindwings. The postmedial lines are often distinct, broader and darker, more blackish than on the upperside. Abdomen covered with a mixture of pale grey and black scales.

Male genitalia (Figs. 5–8). Uncus elongate, broadened basally, membranous with numerous pores and some long setae. Anal tube thin, with elongate patch of short stout setae. Valve relatively short, with smoothly curved ventral margin, medially slightly broadened. Anterior arms of labides without membranous papillae, but covered with medium-sized setae on each apex. Juxta broad, rectangulate, with heavily sclerotized broad and elongated apical lobes. Vinculum large, broad, semicircular. Phallus thin and elongated, slightly curved, with broadened anterior end, shorter than length of valve. Vesica armed with two apical horn-like cornuti, one thin spine-like cornutus near ductus ejaculatorius base and some small spine-like cornuti. Sternite A8 large, broad, with narrow, heavily sclerotized basal margin and two broad apical rods which are curved, pointed and sclerotized to their apices.

Female genitalia (Fig. 9). Bursa copulatrix large, ovate, membranous, with large globular membranous diverticulum at base, armed with small, rather indistinct scobinate signa in the medial part. Ductus bursae thin and elongated, inclined to one side, heavily sclerotized. Ductus seminalis long and thin, membranous, attached to the posterior part of the ductus bursae near to the border with the antrum. Colliculum absent. Antrum narrow, slightly sclerotized. Lamella antevaginalis large, almost inversely heart-shaped, heavily sclerotized and wrinkled. Tergite A8 almost quadrate, with narrowly sclerotized anterior margin and rounded posterior corners. Anterior and posterior apophyses relatively short and thin, but anterior apophyses slightly thicker than posterior ones. Basal arms of anterior apophyses thin, slightly broadened to apices. Papillae anales large, elongated, tapering to tips.

Habitat. The species was collected in the northern slopes of the Elburz Range along the southern coast of the Caspian Sea and in Talysh Mts., at the altitude of about 150–500 m above sea level, in the humid hyrcanic forests. Most specimens were collected at light during the night; only one specimen was collected in the daytime. The natural vegetation of the area consists of the broad-leaved humid hyrcanic forest with *Quercus castaneifolia*, *Fagus orientalis*, *Tilia begonifolia* and also *Crataegus meyeri*, *C. microphylla*, *C. kyrtostyla*, *Pyrus grossheimii*, *Malus orientalis*, *Prunus divaricata* and *P. spinosa* dominating.

Life history. The moths were collected from the mid-May to late June together with *Pasiphila rectangulata* (Linnaeus, 1758) and *Chloroclystis v-ata* (Haworth, 1809). The foodplants are unknown, but the larvae may feed on flower buds or flowers of *Prunus* or *Crataegus*.



Figs. 5–9. Male and female genitalia of *Pasiphila hyrcanica* sp. n. **5.** Male genitalia. **6.** Male eighth sternite. **7–8.** Phallus lateral and ventral, with vesica semi-everted (slide no. 1759, IAET). **9.** Female genitalia (slide no. 3191, IAET).

Distribution. The species is known from the northern slopes of the Elburz Range along the southern coast of the Caspian Sea (North Iran), including Talysh Mts. (south-eastern Azerbaijan).

Derivatio nominis. The name of the new species is derived from that of Hyrcanian biogeographical province, where the species is distributed. Initially the same species was supposed to be a local endemic of Talysh Mts. and mentioned in literature as *Pasiphila talyshensis* Viidalepp (*nomen nudum*) (Mironov, 1990). The subsequent citation (Viidalepp 1996) does not validate this name (ICZN 11.5.2), and we propose for the species a new name, *Pasiphila hyrcanica* Viidalepp & Mironov. Talysh area is merely northern periphery of the Hyrcanian province, and the new name will indicate wider distribution of the species in the province.

Differential diagnosis. This species is externally very similar to *Pasiphila chloerata* (Mabille, 1870) and can easily be confused with the latter. It differs from *P. chloerata* and *P. rectangulata* in the straighter course of dark postmedial line underneath and for having larger black discal spots. However, the male genitalia of *P. hyrcanica* may be easily distinguished by the elongated patch of stout setae on the ventral surface of the anal tube, the narrowly rounded apex of valve, the longer and broader apical lobes of juxta, the longer and slimmer phallus and the shape of the eighth sternite with broader lyre-shaped apical arms than in *P. chloerata*. Female genitalia differ in the shape of bursa copulatrix, in having one patch of very small, indistinct scobinate signa, and for the inclined and sclerotized ductus bursae, the narrower antrum and the almost inversely heart-shaped wrinkled lamella antevaginalis. In our opinion, *P. hyrcanica* must be placed near to *P. chloerata* (Mabille, 1870) and *P. subcinctata* (Prout, 1915) in the list of species of the genus *Pasiphila*, based on external similarity to both these species and on the basis of the structure of the male and female genitalia.

Acknowledgements

We thank to V. Prasolov (St. Petersburg, Russia), T. Marnot (Tallinn), A. Lindt (Estonian Museum of Natural History, Tallinn), A. K. Zaguljaev and S.Yu. Sinev (Zoological Institute, Russian Academy of Sciences, Saint Petersburg) and M. Sommerer (Munich) for access to their collections and for lending the material from Azerbaijan and Iran. Maie Roos kindly revised the English text. Funding of the first author was provided by the Estonian Science Foundation, grant 5750.

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Revision of the *Turanana endymion* species-group (Lycaenidae) – a correction

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In my recent paper entitled ‘Revision of the *Turanana endymion* species-group (Lycaenidae)’, on page 265, text lines 8 & 9 of *Nota lepid.* 27 (4), of the year 2004, one can read that ‘Valvae with the above-described configuration are also illustrated in Tshikolovets (1998) from Turkmenistan’, implying that the Turkmenistan *Turanana* under consideration are *endymion ahasveros* (Bytinski-Salz & Brandt, 1937). This was based on Tshikolovets’ treatment of this taxon as it appears in his book ‘The butterflies of Turkmenistan’, Kyiv, 1998, 237 pp., as well as on the appended rather unclear genitalia illustrations. Since then I received a corrective message from Dr. Vladimir Dubatolov of Russia, who told me that the Turkmenistan *Turanana* specimens under consideration from the Kopetdagh Mts. (this being the same locality as for the Tshikolovets specimens) are actually *Turanana dushak* Dubatolov, 1989 (Trudy Zool. inst. 200: 136, figs. 1–7), a separate species with distinct valval characters. The valva of this species is also clearly illustrated in ‘A guide to the butterflies of Russia and adjacent territories’ by Tuzov et al., Pensoft, Sofia, Bulgaria, 2000, vol. 2: 580 pp.

In conclusion I would like to extend my thanks to Dr. Dubatolov for providing the information needed for making this correction.

Reisseronia arnscheidi sp. n. aus den Südkarpaten Rumäniens (Psychidae)

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Zusammenfassung. Eine neue Art wird in der Gattung *Reisseronia* Sieder, 1972 aus den rumänischen Südkarpaten beschrieben und Angaben zur Lebensweise und Verbreitung gegeben. Weitere Psychidennachweise aus der Kleinen Walachei (Südkarpaten: Muntii Capatenei und Muntii Lotrului) aus dem Zeitraum von 2000 bis 2005 werden bekannt gegeben.

Abstract. A new species of the genus *Reisseronia* Sieder 1972 is described from the Romanian South-Carpathians. Information is provided on the distribution and life history of the new species. Further species of Psychidae are recorded from the Walachia Minor (South-Carpathiaen: Capatenei Mountains and Lotrului Mountains) from the period of 2000 to 2005.

Key words. Romania, Carpathians, Psychidae, Epichnopteryginae, *Reisseronia arnscheidi* sp. n.

1. Einführung

Die Psychiden des Balkans sind in neuerer Zeit Gegenstand einiger Bearbeitungen (Herrmann & Weidlich 1990; 1999; König & Weidlich 2001; Weidlich, im Druck) gewesen, wobei auch die Gattung *Reisseronia* Sieder, 1972 bereits einbezogen wurde (Weidlich 1989). Aus dieser Gattung sind bislang 10 Arten bekannt, deren Verbreitung sich über Frankreich, Mitteleuropa, Sizilien, den Balkan, der Türkei bis an die russische Wolga und in das Donetzk-Becken der Ukraine erstreckt.

Vor einigen Jahren bekam der Autor aus dem Museum Thomas Witt (München) auch eine Serie einer *Reisseronia*-Art zur Bestimmung übersandt. Es handelte sich um eine offensichtlich noch nicht beschriebene Art. Die Tiere wurden seinerzeit vom österreichischen Psychidenspezialisten Herbert Meier (Knittelfeld) im Jahre 1974 bei „Cozia“ in den Südkarpaten gesammelt. Bei einigen in jüngerer Zeit durchgeführten Balkanexpeditionen konnte diese *Reisseronia*-Art nun näher studiert, umfangreiches Material gesammelt und Angaben zur Lebensweise und Verbreitung gewonnen werden. In den Muntii Capatenei der Südkarpaten wurden am 09. Mai 2000 die ersten acht *Reisseronia*-Säcke bei Salistea (Abb. 1) in der Umgebung von Brezoi gefunden, woraus im Juni die ersten Imagines schlüpften. Die Umgebung des „Monastir Cozia“, entsprechend der Etikettierung von Meier, wurde im Jahre 2002 abgesucht, jedoch ohne Erfolg. Auch eine anschließende Exkursion in die Muntele Cozia erbrachte ebenfalls keinen Nachweis dieser Art, aber eine bemerkenswerte Häufigkeit der *Eosolenobia manni* (Zeller, 1852), über deren Verbreitung in Rumänien bereits berichtet wurde (Weidlich, im Druck).

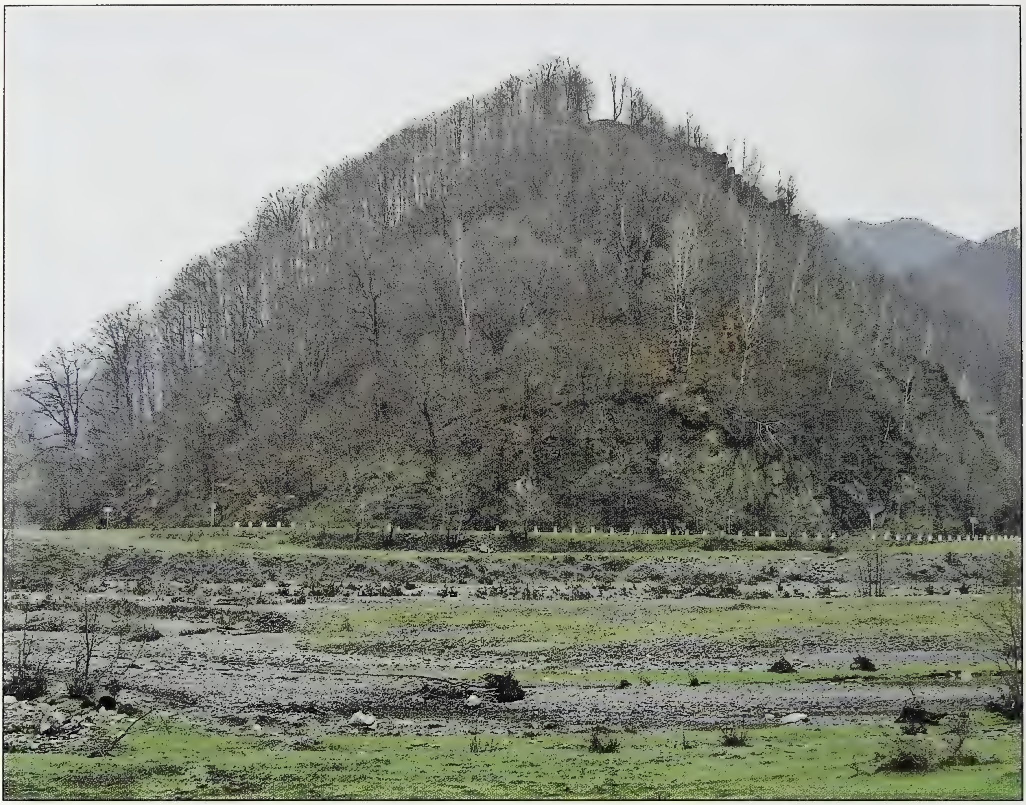

Abb. 1. Lebensraum von *Reisseronia arnscheidi* sp. n. in den Muntii Capatenei, 1 km W Salistea, 450 m, 15.iv.2005 (Foto: Weidlich).

2. Beschreibung von *Reisseronia arnscheidi* sp. n.

Material. Holotypus: 1♂ **Romania**, Karpaten, Monastir Cozia, 300 m, 8.vi.1974, leg. Meier, coll. Museum Witt (München). Paratypen (die gezüchteten Exemplare jeweils mit Sack und Puppenhülle): 38♂ gleiche Daten wie Holotypus, aber 28.v., 1., 3., 5., 8., 10., 11., 12., 15., 17., 18., 20., 21., 22., 23., 24., 25., 26., 28.vi., 1.vii.1974 (ex larva), 2♂ (Dauerpräparate) 28.05., 22.06.1974, 26♀ gleiche Daten wie Holotypus, aber 1.vi.–10.vii.1974, leg. Meier. 5♂, 1♀ Südkarpaten, NO Muntii Capatenei, 1 km W Salistea, 450 m, 1., 4., 6.vi.2000, 20.v.2001, E.v.2005 (alle ex larva) [+5 Säcke 9.v.2000, 6 Säcke 15.iv.2001, 10 Säcke 25.iv.2002, 8 Säcke 19.iv.2003, 15 Säcke 15.iv.2005]; 4♂, 6♀ Südkarpaten, Muntii Capatenei, NO Brezoi, W Valea Lui Stan, 350–400 m, 1.v., 18., 19.v., 3.vi., M., E.vi.2002, 29.v.2003, A.vi.2004 (alle ex larva) [+5 Säcke 15.iv.2001; 18 Säcke 25.iv.2002, 21 Säcke 19.iv.2003, 38 Säcke 15.iv.2004]; 9♂, 8♀ Südkarpaten, NO Muntii Capatenei, 3 km N Chiaculata, 350 m, 11., 12., 19., 20., 26., 27.v., A.vi.2004, A.vi.2005 (alle ex larva) [+ 4 Säcke 25.iv.2002, 64 Säcke 18./19.iv.2003, 69 Säcke 18.iv.2004, 73 Säcke 15.iv.2005]; 3♂, 5♀ Südkarpaten, S Muntii Lotrului, 5 km N Brezoi, 350 m, M.v.2004, A.vi.2005 (alle ex larva) [+8 Säcke 19.iv.2004, 3 Säcke 15.iv.2005]; 1 Sack 10.v.2000, Südkarpaten, NO Muntii Capatenei, Valea Mascesului, 600 m; 2 Säcke Südkarpaten, NO Muntii Capatenei, 3 km S Brezoi, 350 m, 15.iv.2001, leg. Weidlich. Das Material befindet sich im Museum Witt (München), Naturkundemuseum der Humboldt-Universität zu Berlin, coll. W. Arnscheid (Rösrath / Deutschland), coll. E. Hauser (Wolfern / Österreich), coll. P. Hättenschwiler (Uster / Schweiz) und coll. M. Weidlich.

Diagnose. Männchen. Kleine Falter mit einer Flügelspanne von 7,5–9,5 mm. Augen schwarz, rund, ohne Ocellen, Augenabstand etwas größer als der Augendurchmesser (etwa 1,2). Stirnschopfbehaarung, schwarzbraun, dicht und eng anliegend (Abb. 2).

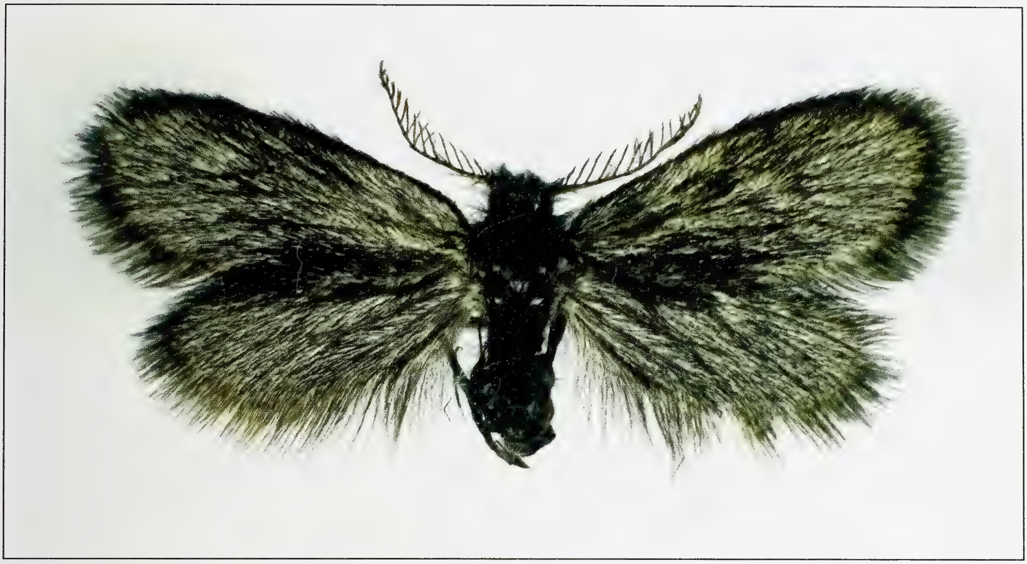

Abb. 2. *Reisseronia arnscheidi* sp. n., Paratypus, 3 km N Chiaculata, 350 m, Anfang Juni 2004 (e. l.), Foto: Knut Leeder.

Fühler relativ kurz, Fühlergliederzahl insgesamt 19, 16 Fühlerglieder doppelkammzähnig, welche etwa doppelt so lang wie die Fühlerglieder sind. Kammzähne sind lang und schütter bewimpert. Vordertibie ohne Epiphyse, Mittel- und Hintertibien mit jeweils einem Spornpaar. Alle Beine mit 5 Tarsengliedern. Körper schwärzlich behaart, erscheint dunkler als die Flügel. Vorderflügelfärbung schwarzbraun, dicht beschuppt mit zweizackigen, schmalen Schuppen (Schuppenklasse I nach Sauter 1956), Fransen einzackig, Färbung nicht andersartig. Aderung unter der Beschuppung nicht erkennbar. Vorderflügeladerung mit Anhangszelle und 8 Discoidalzelladern. Hinterflügelfärbung wie die der Vorderflügel, Adern ebenfalls unter der Beschuppung nicht erkennbar.

Männliches Genital (Abb. 3). *Reisseronia*-typisch, Tegumen-Dach schmal, gewölbt, Clavus lang, schmal mit sägezahnartiger Spitze, Saccus kurz aber deutlich sichtbar. Aedaeagus weist keine Besonderheiten auf, ohne Cornuti.

Weibchen. Körper gestreckt, flügellos, von bräunlicher Färbung; Körperdurchmesser 1–1,5 mm, Länge 4–4,5 mm. Kopf und Thorax stärker sklerotisiert, dadurch dunkler, Augen schwarz, oval ohne Ocellen, Fühlergliederzahl 2–3. Beine mit 1–2 Tarsengliedern. Körper mit weißen Haaren, besonders lang und deutlich erkennbar am Kopf und Thorax, am 7. Abdominalsegment kranzförmig und sehr dicht ausgebildet, Legeröhre relativ kurz.

Sack (Abb. 4). Säcke geschlechtsdimorph; die weiblichen Säcke deutlich größer als die der Männchen. Länge 5–7 mm (♂), 8–10 mm (♀), Durchmesser 1 mm (♂), 2 mm (♀), langgestreckt und *Reisseronia*-typisch etwas bauchig. Sie bestehen aus eng anliegenden Grasteilchen, die längs ausgerichtet sind. Selten werden auch kleine Blattteilchen in den Sack eingebaut.

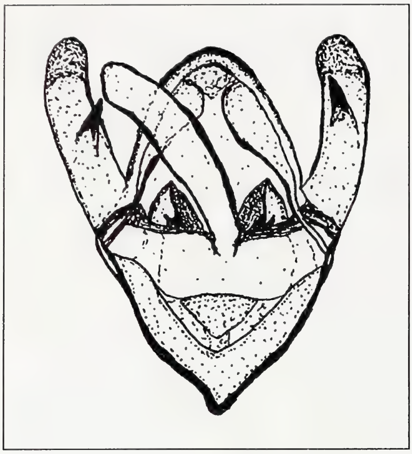

Abb. 3. Männlicher Genitalapparat von *Reisseronia arnscheidi* sp. n., caudal (Zeichnung: W. Arnscheid).

Differentialdiagnose. Aufgrund deutlicher artspezifischer Unterschiede kann auf eine genauere vergleichende Darstellung mit der sizilianischen *Reisseronia hofmanni* (Heylaerts, 1879), der österreichischen parthenogenetischen *R. gertrudae* Sieder 1962, der griechischen *R. magna* Hättenschwiler, 1982 und *R. (Tsikalasia) malickyi* Hauser, 1996, der kleinasiatischen *R. flavociliella* (Mann, 1864) und osteuropäischen *R. staudingeri* (Heylaerts, 1879) und *R. tschetverikovi* Solyanikov, 1990 verzichtet werden. Einbezogen in die vergleichende Untersuchung wurden aber die ähnlichen Arten *R. tarnierella* (Bruand, 1851), *R. nigrociliella* (Rebel, 1934) und *R. pusilella* (Rebel, 1941). Bei den Männchen unterscheidet sich *R. arnscheidi* sp. n. von diesen drei Arten durch die um mindestens 1 höhere Anzahl von gekämmten Fühlergliedern sowie durch die längere Bewimperung der Kammzähne. Von *R. tarnierella* ist sie durch die konstant größere Flügelspannweite sowie die Länge der Kammzähne, welche etwa 2,5 mal so lang wie die Fühlergliederlänge sind verschieden, während sie bei *R. tarnierella* nur etwa 2 mal so lang sind (gemessen am 9. und 10. Fühlerglied); außerdem ist die Ausbildung des Saccus unterschiedlich. Von *R. nigrociliella* und *R. pusilella* ist *R. arnscheidi* durch einen anderen Genitalbau unterscheidbar, insbesondere durch die Ausbildung des Tegumendaches und die Form des Clavus (vgl. Tab. 1). Die Weibchen der neuen Art zeigen deutliche Unterschiede zu denen von *R. pusilella* in der Anzahl der Fühler- und Tarsenglieder und zu denen von *R. nigrociliella* vor allem in der Tarsengliederzahl. Die Unterschiede der Weibchen zu *R. tarnierella* sind relativ gering, bei Serienuntersuchung lassen sich unterschiedliche Durchschnittswerte in der Anzahl der Fühler- und Tarsenglieder sowie in der Körpergröße feststellen. Die *R. tarnierella* Weibchen sind durchschnittlich größer. Der Sackaufbau ähnelt dem der näher verglichenen Arten.

Derivatio nominis. Diese neue Art ist meinem Freund Wilfried Arnscheid in Dankbarkeit gewidmet.

3. Zur Verbreitung und Lebensweise von *Reisseronia arnscheidi*

Nach den ersten Funden im Jahre 2000 wurden während der nachfolgenden Jahre in den Muntii Capatenei verschiedene Populationen gefunden. So konnte *R. arnscheidi* sp. n. bei Chiaculata, Brezoi, Valea Lui Stan, Salistea und Valea Macesului in mehreren Populationen nachgewiesen werden, die stellenweise individuenstark waren. Einen weiteren Fund in den nördlich benachbarten Muntii Lotrolui nördlich von Brezoi gab es dann 2004. Schwerpunktmäßig kommen sie in Höhen zwischen 350 und 450 m NN vor, im Valea Macesului bei 600 m NN.

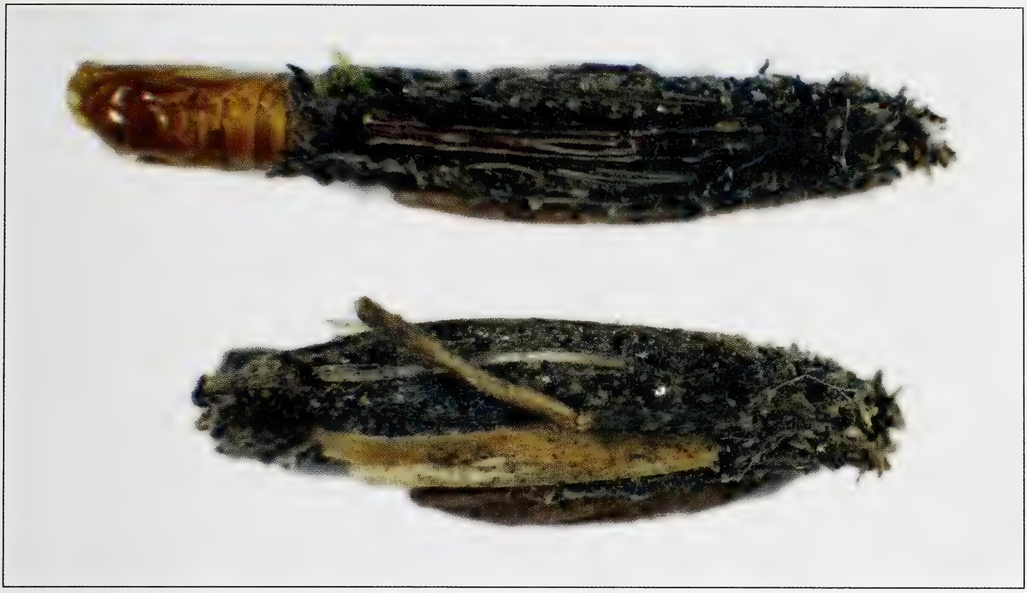

Abb. 4. *Reisseronia arnscheidi* sp. n. **Oben.** Männlicher Sack mit Puppenhülle, 3 km N Chiaculata, 350 m, Anfang Juni 2004 (e. l.). **Unten**. Weiblicher Sack, W Valea Lui Stan, 400 m, 01. Mai 2002 (e. l.).

Die Lebensräume bilden Felshänge und Felswände mit anstehendem Gestein, die südost-, süd- und südwestexponierte Lagen aufweisen.
Aktive Raupen wurden hauptsächlich auf Moospolstern aufgefunden. Im Allgemeinen leben sie sehr versteckt und oftmals fressen sie sich regelrecht in die Moospolster hinein und schauen nur mit dem hinteren Teil des Sackes heraus. Zur Verpuppung spinnen die Raupen ihren Sack meist in Felsspalten an, teilweise aber auch an Grashalmen.
Die Art ist univoltin. Die Imagines schlüpften bei der Zucht zwischen Mitte Mai und 01. Juli (Männchen) und Anfang Mai bis Ende Juni (Weibchen).
Die Schlupfzeit der Männchen wurde in den Morgenstunden zwischen 7 und 10 Uhr registriert, lockende Weibchen konnten um 11 Uhr (MSZ) beobachtet werden.
R. arnscheidi sp. n. ist mit folgenden Psychidenarten vergesellschaftet: *Siederia transsilvanica* Herrmann & Weidlich, 1999, *Dahlica triquetrella* (Hübner, 1813), *Dahlica* sp., *Taleporia tubulosa* (Retzius, 1783), *Melasina ciliaris* (Ochsenheimer, 1810)., *Psyche casta* (Pallas, 1767), *Psyche crassiorella* (Bruand, 1851), *Bijugis* sp., *Rebelia* sp., *Canephora hirsuta* (Poda, 1761) und *Apterona helicinoides* (Vallot, 1827).

4. Weitere Beobachtungen zur Psychidenfauna der Muntii Capatenei und Muntii Lotrului in den Jahren 2000 bis 2005

Die nachfolgenden Angaben stammen aus den Zeiträumen 9.–10.v.2000, 15.iv.2001, 24.–25.iv.2002, 18.–19.iv.2003, 18.–19.iv.2004 und 14.–15.iv.2005. Eine Gesamtübersicht ist in der Tab. 2 dargestellt.

Tab. 1. Übersicht wichtiger Merkmale von *Reisseronia*-Arten (ergänzt nach Sieder 1972 und Weidlich 1989).

	Reisseronia tarnierella	***Reisseronia nigrociliella***	***Reisseronia pusilella***	***Reisseronia arnscheidi***
Männchen				
Schopf	dunkel graubraun	schwarz, dicht behaart	schwarz, lang behaart	schwarz, lang behaart
Fühlerglieder	13 bis 15	12 bis 14	12 bis 14	16
Länge 9./10.Kammfühlerglied/Fühlergliedlänge	ca. 2	ca. 2	ca. 2	2,5
Länge Kammfühlerbehaarung/Kammfühlerbreite	etwa gleichlang	etwa gleichlang	etwa gleichlang	deutlich länger
Vdfl.-Spannweite (mm)	6 bis 7	9 bis 10	8 bis 8,5	7,5 bis 9,5
Vdfl.-Färbung	schwarzbraun	mittelbraun	dunkelbraun	schwarzbraun
Deckschuppen - Zackigkeit	zweizackig	zweizackig	zweizackig	zweizackig
Tegumen - Dach	schmal, einfach gewölbt	breit, schwach doppelkopfförmig	breit, doppelkopfförmig	schmal, einfach gewölbt
Clavus	lang, schmal, sägezahnartig	lang, breit, sägezahnartig	lang, breit, sägezahnartig	lang, schmal, sägezahnartig
Saccus - Form	nicht vorhanden oder sehr, sehr kurz	nicht vorhanden	kurz, aber deutlich	kurz, aber deutlich
Phallus	kurz, leicht gebogen	kurz, leicht gebogen	kurz, leicht gebogen	kurz, leicht gebogen
Weibchen				
Länge x Breite (mm)	5 bis 6,5 × 1 bis 1,5	6 bis 7 × 1,5 bis 2	5 bis 6 × 1 bis 1,5	4 bis 4,5 × 1 bis 1,5
Färbung	hellbräunlich	weißlichgelb	mittelbräunlich	mittelbräunlich
Fühlerglieder	2 bis 3	2	5 bis 6	2 bis 3
Tarsenglieder	2 bis 3	4 bis 5	3	1 bis 2
Säcke				
Länge (mm) (Männchen)	6 bis 7	6 bis 8	um 7	5 bis 7
Länge (mm) (Weibchen)	um 8	7 bis 12	um 10	8 bis 10
Durchmesser (mm) (Weibchen)	2	2,5 bis 3,5	um 2	um 2
Phänologie	Ende Mai - Mitte Juni	Anfang Juni - Ende Juli	Ende Juni - Mitte August	Anfang Mai - Anfang Juli
Verbreitung				
Staat	F, D, NL,BL, I	MK, BG, GR	MK, BG, GR	RO
Landschaft - Fundorte	Westfalen, Brabant, Friaul	Pirin	Bistra, Pirin, Olymp	Südkarpathen
Höhenverbreitung	0–300 m NN	200–600 m NN	600–2000 m NN	300–600 m NN

Tab. 2. Übersicht nachgewiesener Psychidenarten in der Kleinen Walachei (Südkarpathen) in den Jahren 200 bis 2005.

	Muntii Capatenei N Chiaculata 350 m	**Muntii Capatenei Umg. Valea Lui Stan 350–400 m**	**Muntii Capatenei Umg. Salistea 400–450 m**	**Muntii Capatenei Umg. Malaia 500–550 m**	**Muntii Capatenei Valea Macesului 600 m**	**Muntii Lotrului Umg. Voineasa 600–1050 m**	**Muntii Lotrului N Brezoi 350–400 m**
Dahlica triquetrella	×	×	×			×	
Dahlica sp.	×	×	×	×	×	×	×
Siederia transsilvanica	×	×	×	×			
Taleporia tubulosa	×	×	×	×	×	×	×
Melasina ciliaris					×	×	×
Proutia betulina						×	
Psyche casta	×	×	×	×	×	×	×
Psyche crassiorella	×				×	×	
Bijugis sp.	×						
Reisseronia arnscheidi	×	×	×		×		×
Rebelia sp.			×				×
Acanthopsyche atra						×	
Canephora hirsuta	×				×		×
Ptilocephala plumifera						×	
Apterona helicoidella	×						×

Nach dem Verzeichnis der Schmetterlinge Rumäniens (Rakosy, Goia & Kovacs 2003) werden folgende Arten erstmalig aus der Kleinen Walachei (Oltenia) gemeldet:

Siederia transsilvanica wurde 1986 in den Südkarpaten bei Petrosani entdeckt und 1999 beschrieben. Die Vorkommen liegen in den östlichsten Teilen der Muntii Vulcanului und den westlichsten Bereichen der Muntii Paringului (Transsilvania-Siebenbürgen). Die neuen Nachweise in den Muntii Capatenei und Muntii Lotrului liegen etwa 50 bis 70 km weiter östlich (Oltenia-Kleine Walachei). Die bekannte Höhenverbreitung erstreckt sich nunmehr zwischen 300 m und 1050 m NN. Besonders häufig ist *S. transsilvanica* in der Umgebung von Malaia, wo die Säcke zu Hunderten an Felsen aufgefunden werden konnten.

Taleporia tubulosa ist ebenfalls weit verbreitet, aber nicht so häufig wie *P. casta* und ist hauptsächlich an Felsen bei Salistea, Valea Lui Stan, Chiaculata, Malaia, Valea Macesului, Voineasa und Brezoi zu finden.

Die Säcke von *Psyche casta* sind meist in Anzahl bei Salistea, Valea Lui Stan, Chiaculata, Malaia, Valea Macesului, Voineasa und Brezoi an Felsen zu finden.

Acanthopsyche atra (Linnaeus, 1767): 1 Sack, ca. 7,5 km W Voineasa, 1050 m, 10.v.2000, an Felsen angesponnen und weitere 5 Säcke am 24.iv.2002 an gleicher Stelle.

Ptilocephala plumifera (Ochsenheimer, 1810): 2 Säcke, ca. 7,5 km W Voineasa, 1050 m, 10.v.2000, 24.iv.2002.

Für folgende Arten liegen lediglich alte Funde bzw. Nachweise aus dem Zeitraum 1901–1980 vor (vgl. Rakosy, Goia & Kovacs 2003):

Canephora hirsuta: 1 Sack Valea Macesului E Voineasa, 600 m, 10.v.2000; 2 Säcke ca. 3 km N Chiaculata, 350 m, 25.iv.2002, 18.iv.2003; 1 Sack ca. 2 km S Riu Vadului bei Brezoi, 400 m, 19.iv.2004 an Felsen.

Apterona helicinoides: 1 Sack an Felsen, ca. 3 km N Chiaculata, 350 m, 18.iv.2003; 1 Sack 5 km N Brezoi, 350 m, 19.iv.2004.

Außerdem wurden drei noch nicht bestimmte bzw. bestimmbare Psychidenarten im Untersuchungsgebiet gefunden: *Dahlica* sp.: Ebenfalls weit verbreitet bis häufig bei Salistea, Valea Lui Stan, Chiaculata, Malaia, Valea Macesului, Voineasa und Brezoi. Ein Männchen konnte am 25.iv.2002 um 7.34 Uhr (MESZ) fliegend beobachtet werden. In der Zucht schlüpften die Männchen vom 21.iv.–15.v. und die Weibchen zwischen dem 19.–30.iv. Bei der großen Zahl an *Dahlica*-Populationen im Karpatenbogen ist es notwendig, eine umfassende Revision voranzustellen, um die Artenproblematik zu lösen und eine abgesicherte Determination zu gewährleisten. Bereits Herrmann & Weidlich (1990) haben auf diese Gesamtproblematik hingewiesen und die Populationen aus den Muntii Vulcanului und Muntii Paringului provisorisch *Dahlica wagneri* (Gozmany 1952) zugeordnet.

Rebelia sp.: Je 1 Sack am 19.iv.2003 1 km W Salistea 450 m und am 19.iv.2004 ca. 2 km S Riu Vadului 400 m an Felsen.

Bijugis sp.: Ein einzelner Sack wurde am 18.iv.2004 an Felsen ca. 3 km N Chiaculata 350 m entdeckt, der ein Weibchen am 17.vi.2004 ergab. Sehr wahrscheinlich handelt es sich um *Bijugis bombycella* ([Denis & Schiffermüller], 1775), die bereits aus der Kleinen Walachei gemeldet wurde (vgl. Rakosy, Goia & Kovacs 2003).

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Factors influencing nectar plant resource visits by butterflies on a university campus: implications for conservation

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Abstract. Floral attributes are well known to influence nectar-feeding butterflies. However, very little information is available on butterfly species and their nectar host plant relationships from north central India. The present study was carried out on Amravati University Campus from July 2004 to January 2005. A total of 48 butterfly species was recorded belonging to five families and included five species previously unrecorded on the campus. Nineteen nectar host plants were identified belonging to 12 plant families. Visits of butterflies were more frequent to flowers with tubular corollas than to non tubular ones, to flowers of herbs and shrubs rather than trees, to flowers coloured red, yellow, blue and purple than those coloured white and pink, and to flower sources available for longer periods in the year. Flower abundance, flowering period, flower colour and flower shape correlate significantly with plant habit, trees having sparser flowers generally with shorter flowering periods, less bright colours and non tubular flower shapes. A number of butterflies were observed to visit more (*Danaus chrysippus*, *Tirumala septentrionis*) or fewer flower (*Zizula hylax*) sources than expected and one plant (*Bauhinia purpurea*) had fewer visiting butterfly species than expected. The observations support the value of the university campus in providing valuable resources for butterflies.

Key words. India, Lepidoptera, Amravati University, resources, habitat, nectar plants, diversity, plant structure.

Introduction

Amravati University Campus (area 190 ha) is situated at about 4 km north east of city Amravati (20°50'N 77°47'E) in the Pohara Forest Range (Maharashtra State of India). The east side of the campus is hilly and covered by the Pohara Malkhed Reserved Forest range. The campus, well known for its gardens, is occupied by tree plantations, ornamental plants in garden plots, a nursery and flowering plants around buildings; wild grasses and plants are spread over the campus. Many of the flowering plants are used by butterflies as nectar plants and support a rich diversity of butterflies. To determine the conservation value of the flowering plants for butterfly diversity a study has been carried out on nectar source visits by butterflies on the university campus based on previous checklists for both plants and butterflies (Palot 1998; Nair 2002). Earlier studies in the region have demonstrated the impact of larval host plants and nectar plants on the status of butterflies (Culin 2004; Solman Raju et al. 2004).

Within the region of Amravati, butterflies do not feed indiscriminately from any flower they find. They show preference for certain nectar flowers with specific chemical composition (Kunte 2000). But, very little information is available on feeding habits and food resources of adult butterflies compared to that of the larvae (Kunte 2000). The present study on the Amravati University Campus is a preliminary attempt to determine the link between characteristics of floral nectar plants and the butterflies using them as nutrient sources.

Methods and Materials

The findings presented here are based on a field survey and investigation carried out by the first author on a daily basis from July 2004 to January 2005 on the Amravati University Campus during the peak flowering period (tropical seasonal climate). Observations were made during a fixed daily transect carried out between 7.00 h to 10.00 h and 17.00 to 18.00 h outside teaching hours. Species were identified directly in the field or, in difficult cases, following capture or photography. Collecting was restricted to those specimens that could not be identified directly.

Butterflies were identified from Wynter-Blyth (1957), Gey et al. (1992) and Kunte (2000). Specific observations were made on each plant species visited by butterflies: plant habits, flowering period and floral characteristics such as colour and shape of corolla were examined. Specimens from the plant species visited by butterflies were photographed and/or collected and identified by the second author (VPD).

All scientific names follow Varshney (1983) and common English names are after Wynter Blyth (1957). Based on number of sightings butterfly species were categorized into very rare (< 2 sightings), rare (2–15 sightings), not rare (15–50 sightings), common (50–100 sightings) and very common (more than 100 sightings) and ranked from 1 (very rare) to 5 (very common). Availability of flowers (abundance of flowers) for flowering plants on the campus was placed into three categories, (1) sparse, (2) moderate and (3) dense, reflecting changes in abundance in orders of magnitude.

For analysis, plants were classed for habit, (tree, shrub, herb), corolla shape (tubular and non-tubular), flowering period (all year or restricted to less than half a year) and colour (white, pink, red, yellow, blue and purple with cream treated as white). Flower colour was also simplified into white/pink versus red/yellow/blue/purple. Number of flower visits by butterflies, number of flower categories visited by butterflies and number of butterfly species visiting flowers have been normalised (sqrt_x, loge_x); in all regression analyses the residuals have been tested for normality.

Four issues are investigated: (i) the relative dependence on nectar sources by butterflies, (ii) the range of nectar source use by butterflies; (iii) the size of the nectar feeding butterfly guild on flowering plants, and (iv) the influence of attributes of flowering plants (abundance, habit, colour, flowering period and corolla shape) on nectaring visits across species. For the second and third investigations, no assumption is made as to the form of the positive relationship between species making visits and visits observed beyond that it is linear following transformation for normality. This differs from the model used by Tudor et al. (2004) which assumes a strict logarithmic curve following Gleason's method of relating species number to area; although the transformations required supported a general fall off in species for increasing number of observations, this was not always found to follow a strict logarithmic model. In the second investigation, a butterfly species seen feeding frequently is likely to feed on more flower species than one seen rarely. Positive deviations from this pattern would indicate generalism, and negative deviations specialism in the feeding habits of the butterfly. In the third investigation, flower species more popular than expected will have more butterfly species feeding on them and those less popular than expected will receive fewer butterfly species than expected. The fourth investigation involves direct comparisons applying t tests and ANOVA and associations using Gamma, which accounts for tied values (Goodman & Kruskal 1972). All analyses have been carried out in STATISTICA (Statsoft 1999).

Results

During the course of study 48 species of butterflies, belonging to 5 families, were recorded; five were new records for the university campus. These species were found utilizing the flower nectar of 19 plants species belonging to 12 families. Most butterflies recorded belong to the Nymphalidae (22 species) with two new records to the campus (i.e., *Tirumala septentrionis* (Dark blue tiger) and *Parantica aglea* (Glossy tiger)). Eleven Lycaenidae species were recorded with one new record (i.e. *Rapala larbus* (Indian red flash)). A further 10 Pieridae species were recorded with two new records (i.e., *Cepora nerissa* (Common gull) and *Pareronia valeria* (Common wanderer)). Only 1 species is recorded from the Hesperiidae and 4 species recorded from the Papilionidae. Among the 48 butterflies recorded three species come under the protection category of the Indian Wild Life (protection) Act 1972 (Kunte 2000). Among them *Hypolimnas misippus* came under schedule I of the act. The species recorded which come under schedule II of the wild life protection act 1972 are *Hypolimnas misippus, Pareronia valeria,* and *Lampides boeticus* (Gupta & Mondal 2005). The list of butterflies along with their common names, occurrence status, and nectar plants utilized by each butterfly species is provided in Tab. 1. The plant species utilized by each butterfly species along with habit, flowering period, colour, and corolla shape is given in Tab. 2. Each plant species included in the present study was utilized by more than one butterfly species.

Observed versus expected nectaring events. To determine whether species were observed visiting flowers as often as expected from their general abundance on the campus, the number of nectar visits by butterfly species has been regressed against their abundance coding. A significant correlation is found ($F_{1,46} = 34.18$, $R^2 = 42.6\%$, $P < 0.00001$, $N = 48$). Three distinctive outliers exist (>|2| standard errors): *Danaus genutia* and *Parantica aglea* were observed to be nectaring far more frequently than expected from their general abundance on the campus and *Melanitis leda* far less frequently from its observed abundance (Fig. 1).

Range of nectar plants used by butterflies. To determine the number of nectar plants used by butterflies, the number of flower groups has been regressed against number of observations (flower visits; Fig. 2). A significant relationship is found ($F_{1,46} = 51.19$, $P < 0.00001$, $R^2 = 52.7\%$, $N = 48$ butterfly species). Three outliers were found (>|2| standard errors); *Danaus chrysippus* and *Tirumala septentrionis* visit significantly more nectar sources than expected and *Zizula hylax* significantly fewer than expected. Other species also tend to have more (e.g., *Catopsilia pomona*, *Byblia ilithyia*) or fewer (e.g., *Zizeeria karsandra*, *Chilades laius*, *Catochrysops strabo*, *Lampides boeticus*) nectar visiting sources than expected.

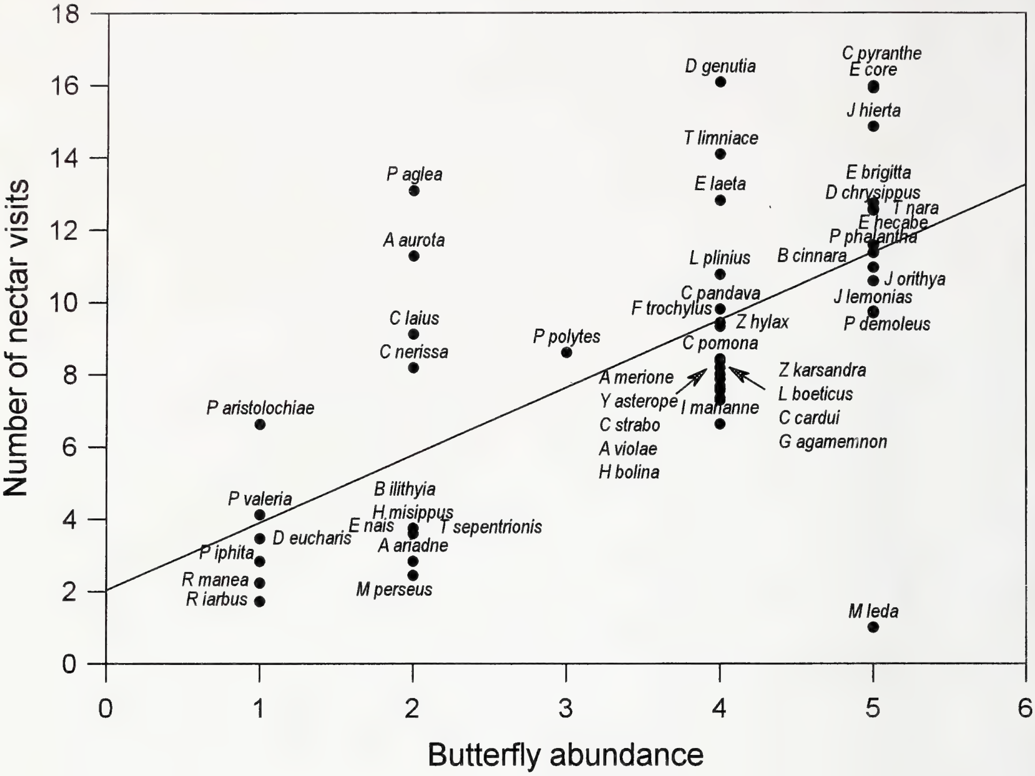

Fig. 1. Number of nectar visits by butterfly species in relation to butterfly abundance on the Amravati University campus. (nectar visits: square root transformed; butterfly abundance: 1 very rare (< 2 sightings), 2 rare (2–15 sightings), 3 Not rare (15–50 sightings), 4 common (50–100 sightings), 5 very common (> 100 sightings); for full names of butterfly species see Tab. 1).

Number of butterfly species feeding on nectar sources. To ascertain the size of the nectar feeding butterfly guild on flowering plants, the number of butterfly species has been regressed on number of observations (flower visits; Fig. 3). A significant relationship is found ($F_{1,17} = 79.74$, $P < 0.00001$, $R^2 = 82.4\%$, N = 19 plants). One outlier is found (>|2| standard errors), *Bauhinia purpurea*, which is visited by fewer butterfly species than expected. A number of other plants have more (e.g., *Jatropha gossypiifolia*, *Lantera camera*) or fewer (e.g., *Gaillardia* spp., *Tribulus terrestris*) butterfly species visiting them than expected.

Factors influencing visits to flowers. Visits to herbs and shrubs were more frequent than visits to flowering trees, but not significantly so ($F_{2,170} = 2.43$, P = 0.09). When shrubs and herbs are combined, this difference increases ($t_{171} = 1.85$, P = 0.07) and the ranked difference is significant (Mann-Whitney U, Z = 2.12, P = 0.03). Flowering period has a significant impact on visits for nectar ($t_{171} = 3.48$, P = 0.0006); plants flowering all year have more visits despite the fact that the survey was carried out for seven months. Flower shape also significantly influences visits for nectar ($t_{171} = 3.12$, P = 0.002); tubular shaped corollas have more visits than those that do not.

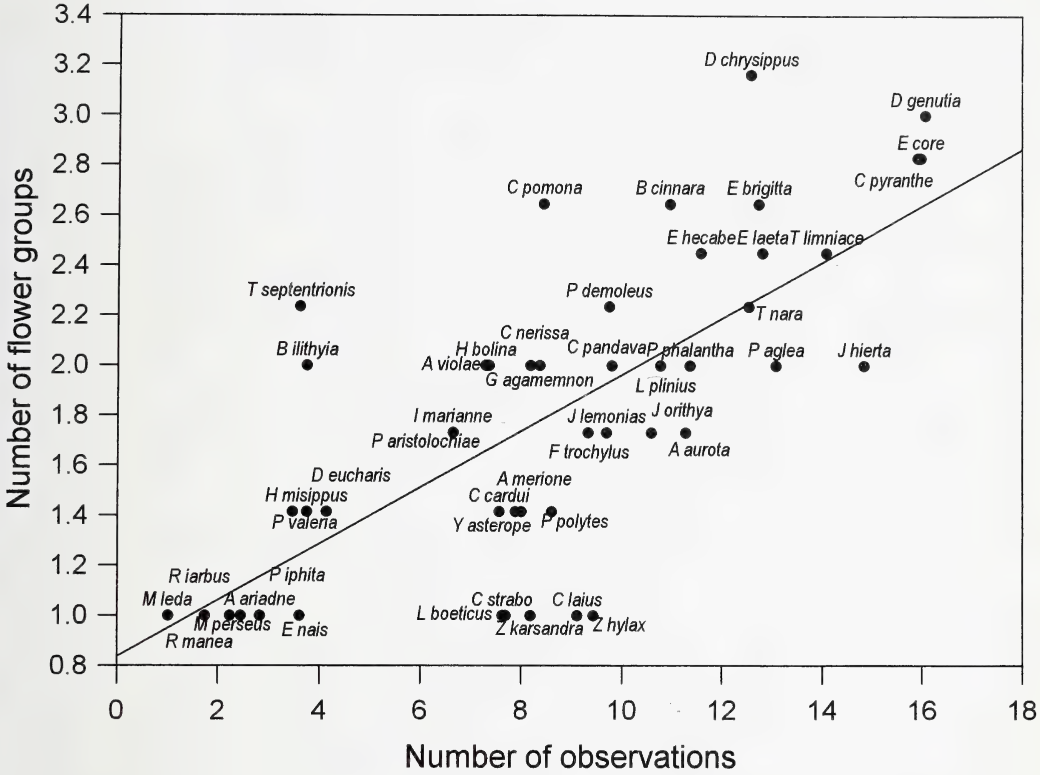

Fig. 2. Number of flower groups visited by butterflies in relation to the number of nectar visits observed (Both axes square root transformed; for full names of butterfly species see Tab. 1).

Flower colour has been tested individually, one flower colour at a time, as well as in a single test distinguishing white/pink flowers from others (red, yellow, blue and purple). White and pink flowers receive fewer visits than flowers of other colours, white flowers significantly so (white: $t = 2.71$, $P = 0.007$, pink: $t = -1.16$, $P = 0.11$, df $= 171$). Red, yellow and blue/purple flowers receive more visits than other colours, though not significantly for red flowers (red: $t = -0.78$, $P = 0.44$, yellow: $t = -2.75$, $P = 0.007$, blue/purple: $t = -2.16$, $P = 0.03$; df $= 171$). When flowers are combined for colour, white/pink flowers receive significantly fewer visits than flowers of other colours (red/yellow/blue/purple) ($t_{171} = 3.89$, $P = 0.0001$).

To determine the **main influences for across butterfly species visits to nectar sources**, number of visits (log transformed) have been regressed using forwards stepwise entry of variables against flower abundance (sparse, moderate, dense), habit (trees versus shrubs/herbs), flowering period (all year versus restricted period), flower shape (tubular/non-tubular) and flower colour (white/pink versus other colours). Three variables were found to significantly contribute to number of visits ($F_{3,169} = 14.52$, $R^2 = 20.5\%$, $P < 0.00001$, $N = 173$): flower abundance ($R^2 = 12.9\%$), flower colour ($R^2 = 4.1\%$) and

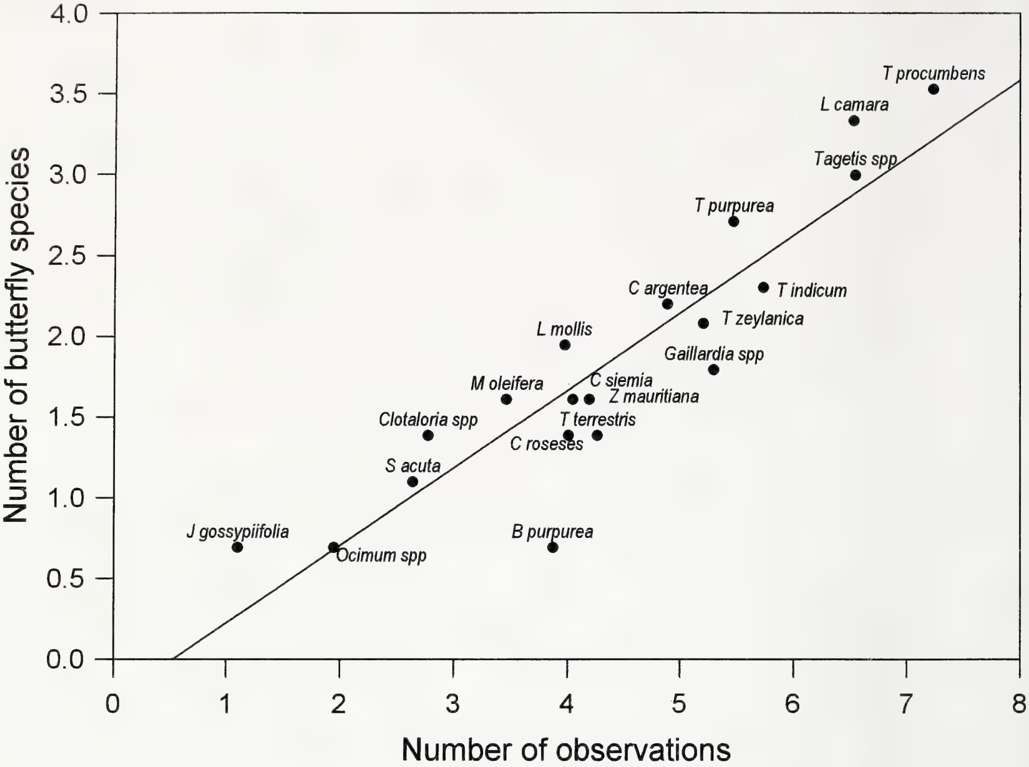

Fig. 3. Number of butterfly species visiting nectar flower groups in relation to the number of visits observed for each flower group. (Both axes log transformed; for full names of plant groups see Tab. 2).

flowering period ($R^2 = 3.5\%$); beta coefficients for all three variables are significant at $P < 0.007$) though the overall explained variance is relatively low. However, habit is highly correlated with flower abundance (Gamma = -1.0), flowering period (Gamma = -0.94, $P < 0.0001$) and flower shape (Gamma = -0.82), and flower shape is highly correlated both with flowering period (Gamma = 0.92) and flower colour (Gamma = 0.95) ($P < 0.0001$ in both cases) (Tab. 3). Trees, which have significantly fewer nectar visits, also have a significantly sparser flowers, shorter flowering period, fewer tubular corollas and more typically have white/pink flowers rather than red, yellow or blue-purple.

Discussion

Observations on nectar visits in butterflies on the Amravati University campus, in a tropical context, support four previous general findings on adult feeding in butterflies mainly from surveys of temperate butterflies (e.g., Faegri & van der Pijl 1979; Jennersten 1984; Porter et al. 1992; Corbet 2000; Tudor et al. 2004): (i) extensive variation in the range of dependency on nectar as a resource, (ii) varying degrees of generalism and

Tab. 1. Flower-visiting butterfly species of Amravati University Campus together with common name, status and nectar host plants. VC Very common (> 100 sightings), C Common (50–100 sightings), NR Not rare (15–50 sightings), R Rare (2–15 sightings), VR Very rare (< 2 sightings). For numbers in nectar host plant column, see Tab. 2.

Butterfly species	**Common Name**	**Status**	**Nectar host plant**
Hesperiidae			
Borbo cinnara	Rice swift	VC	4,5,6,7,16,18,19
Papillionidae			
Papilio polytes	Common Mormon	NR	2,18
Papilio demoleus	Lime Butterfly	VC	7,8,12,16,18
Pachliopta arstolochiae	Common Rose	VR	2,5,8
Graphium agamemnon	Tailed Jay	C	2,5,16,18
Pieridae			
Catopsilia pomona	Lemon Emigrant	C	2,3,5,7,12,15,18
Catopsilia pyranthe	Mottled Emigrant	VC	2,3,5,6,7,15,17,18
Eurema brigitta	Small grass yellow	VC	1,5,7,9,12,15,18
Eurema hecabe	Common grass yellow	VC	7,10,12,17,18,19,
Eurema laeta	Spotless grass yellow	C	1,7,8,9,12,18
Delis eucharis	Common Jezebel	VR	12,18
Anaphaeis aurota	Pioneer	R	7,12,18
Ixias marianne	White Orange Tip	C	7,14,18
Cepora nerissa	Common Gull	R	5,7,12,18
Pareronia valeria	Common Wanderer	VR	5,11
Lycaenidae			
Zizula hylax	Tiny Grass Blue	C	7
Zizeeria karsandra	Dark Grass Blue	C	7
Freyeria trochylus	Grass Jewel	C	1,7,19
Lampides boeticus	Pea Blue	C	1
Chilades laius	Lime Blue	R	7
Leptotes plinius	Zebra Blue	C	1,7,17,18
Tarucus nara	Rounded pierrot	VC	6,7,12,17,18
Catochrysops strabo	Forgot-me-not	C	7
Chilades pandava	Plains Cupid	C	7,17,18,19
Rapala manea	Slate Flash	VR	5
Rapala iarbus	Indian Red Flash	VR	7
Nymphalidae			
Melanitis leda	Common Evening Brown	VC	7
Mycalesis perseus	Common Bushbrown	R	5
Ypthma asterope	Common Three Ring	C	5,7
Junonia hierta	Yellow Pansy	VC	7,8,12,18
Junonia lemonias	Lemon Pansy	VC	1,7,12
Junonia orithya	Blue Pansy	VC	7,8,18
Precis iphita	Chocolate Pansy	VR	12
Danaus chrysippus	Plain Tiger	VC	3,4,6,7,8,9,12,13,16,18
Danaus genutia	Striped Tiger	C	1,4,5,7,8,9,12,16,18
Tirumala limniace	Blue Tiger	C	5,7,8,9,13,18
Tirumala septentrionis	Dark Blue Tiger	R	5,7,9,13,18
Parantica aglea	Glossy Tiger	R	5,8,9,13
Phalanta phalantha	Common Leopard	VC	1,6,7,18
Euthalia nais	Baronet	R	7
Byblia ilithyia	Joker	R	5,7,14,18
Acraea violae	Tawny Coster	C	3,4,6,18
Ariadne merione	Common Castor	C	5,7
Ariadne ariadne	Angled Castor	R	5
Cynthia cardui	Painted Lady	C	7,18
Euploea core	Common Indian Crow	VC	4,5,6,7,8,9,11,18
Hypolimnas misippus	Danaid Eggfly	R	4,18
Hypolimnas bolina	Great Eggfly	C	1,5,10,12

Tab. 2. Nectar host plants and floral characteristics of butterfly species of Amravati University Campus. YL flowering all year: numbers indicate months of flowering; Corolla shape: T tubular, NT non-tubular; flower abundance: S sparse, M moderate, D dense.

No	Plant species or group	Habit	Flowering period	Flower colour	Corolla shape	Flower abundance
	Amaranthaceae					
1	*Celosia argentea*	herb	YL	Pink/white	NT	M
2	*Cussia siemia*	tree	YL	yellow	T	S
	Apocynaceae					
3	*Catharanthus roseses*	shrub	YL	white	T	D
	Asteraceae					
4	*Gaillardia* spp.	shrub	YL	red	T	D
5	*Tagetis* spp.	shrub	YL	Red/yellow	T	D
6	*Lagasca mollis*	herb	6–11	white	T	D
7	*Tridax procumbens*	herb	YL	yellow	T	D
	Boraginaceae					
8	*Trichodesma indicum*	herb	YL	Blue/white	T	M
9	*Trichodesma zeylanica*	herb	YL	yellow	T	D
	Caesalpiniaceae					
10	*Bauhinia purpurea*	tree	9–12	purple	NT	S
	Euphorbiaceae					
11	*Jatropha gossypiifolia*	herb	6–10	red	NT	M
	Fabaceae					
12	*Tephrosea purpurea*	herb	YL	pink	NT	M
13	*Clotaloria* spp.	herb	YL	yellow	NT	M
	Lamiaceae					
14	*Ocimum* spp.	herb	7–10	White	T	D
	Malvaceae					
15	*Sida acuta*	herb	7–11	cream	T	D
	Moringaceae					
16	*Moringa oleifera*	tree	YL	white	T	S
	Rhamnaceae					
17	*Zizyphus mauritiana*	tree	7–11	cream	NT	S
	Verbenaceae					
18	*Lantana camara*	shrub	YL	yellow	T	D
	Zygophyllaceae					
19	*Tribulus terrestris*	herb	6–10	yellow	NT	M

Tab. 3. Associations among nectar plant attributes and nectar visits (Gamma). Abundance: 1 sparse, 2 moderate, 3 dense; Habit: 1 herbs/shrubs, 2 trees; flowering period: 1 < half year, 2 all year; flower colour: 1 white/pink, 2 red/yellow, purple-blue; flower shape: 1 non tubular, 2 tubular. All coefficients are significant at $P < 0.0001$, except that between habit and flower colour with $P = 0.015$; $N = 173$.

Variable	Visits	Flower abundance	Habit	Flowering period	Flower colour
Flower abundance	0.50				
Habit	-0.66	-1.0			
Flowering Period	0.69	0.83	-0.94		
Flower Colour	0.53	0.82	-0.16	0.39	
Flower shape	0.49	0.96	-0.82	0.92	0.95

specialism on flowering plants for nectar, (iii) the wide range in butterfly guilds on different nectar plants, and (iv) and the wide range of physical attributes used as cues for nectar quality or correlating with other (chemical) cues underlying nectar quality of flowering plants.

Butterflies differ in their dependency on nectar for somatic maintenance and reproductive potential (Gilbert 1981). In some species (e.g., *Euphydryas editha bayensis*) females emerge with a fixed number of oocytes in the ovaries, a relatively large proportion of which are chorionated and ready for deposition (Boggs & Nieminen 2004); other species (e.g., *Heliconius* spp.) display continual oogenesis and have no chorionated eggs on emergence (Gilbert 1973); the latter depend highly on adult acquired nutrition. Nutrition for egglaying may be obtained directly from adult feeding or from male reproductive investments as nuptial gifts (Boggs, 1995, Mevi-Schütz & Erhardt 2004). A relationship has previously been found between the abundance of butterflies and the diversity of nectar host plants utilized by them in India (Solman Raju 2004) as elsewhere (e.g., Feber et al. 1996, Swengel & Swengel 2001, Krauss et al. 2003). The current observations at the Amravati University campus suggest that some species (e.g., *Danaus genutia*, *Catopsilia pyranthe* and *Parantica aglea*) are greatly more dependent on nectar sources than other species (e.g., *Rapala iarbus*, *Ixias marianne*, *Mycalesis perseus* and *Melanitis leda*). The substantially fewer observations of nectar feeding in *Melanitis leda* than expected may largely owe to its crepuscular habit (Roberts 2001), but observations were carried out between 17.00 and 18.00h local time and cannot entirely explain the lack of nectar feeding in this butterfly and the closely related *Mycalesis perseus*. As grass feeders they may also be obtaining sustenance from other resources (e.g., ergot; Shreeve 1992) including rotting fruit or sap.

Butterflies have been found to differ in the range of available nectar sources used. In the parlance of host use, they are described as being generalists and specialists respectively. In a previous study in a temperate context, specialist nectar feeders were found to be species of conservation concern, having fewer broods, lower mobility and being associated with specific (taller) plant life forms; there was no relationship with wing size or proboscis length (Tudor et al. 2004). Linked with this it was also found that nectar plants have differently sized butterfly-feeding guilds on them. The present study confirms distinctions of nectar use generalism and specialism and range in guild size for plants, for a tropical context. In particular, *Danaus chrysippus* and *Tirumala septentrionis* use significantly more nectar sources than expected and *Zizula hylax* less sources than expected. Regarding butterfly nectar feeding guilds on plants, *Bauhinia purpurea*, despite being an attractive colour for butterflies, has a very limited guild of butterflies feeding on it. In a recent study of feeding by *Danaus genutia* on four nectar sources (*Crotalaria juncea*, *Nerium oleander*, *Barleria cristata* and *Bauhinia purpurea*) at the Kaziranga National Sanctuary, Assam, India, the fewest visits were also paid to *Bauhinia purpurea* (Bhuyan et al. 2005). The fact that it is a tree species with non-tubular flowers, and a flowering period restricted to a period between September and December, may form part of the reason, factors apparently not offset by flower colour. Unfortunately, biological data are unavailable for the Amravati species to determine underlying biological influences for these associations.

Nectar use has long been linked to flowering attributes, for instance, nectar concentrations (Watt et al. 1974, Pivnick & McNeil 1985), colour and pattern (Faegri & van der Pijl 1979, Jennersten 1984) and structure (e.g., corolla length) (Kingsolver & Daniel 1979) and butterfly morphology (e.g., proboscis length, wing loading) (Porter et al. 1992, Corbet 2000). Learned behaviour is also a feature of flower constancy (Goulson et al. 1997). The present study confirms the influence of flower colour and structure and adds plant habit (tree versus shrub/herb) and length of flowering time. A number of studies in temperate contexts have observed shifts in nectar flower use with emergence period and broods (Porter et al. 1992). In a tropical context flowering time is perhaps even more important than in a temperate context, as butterflies tend to be continuously brooded and require access to a continuous supply of flowering nectar-producing plants that may not be available. Shrubs and herbs provide this significantly more frequently than trees on the Amravati University campus.

The findings of the present study underline the importance of institutional estates, in this case a university campus, in providing resources for butterflies. Often, there are large open areas on college campuses and both ornamental and more functional areas can be diversified for the benefit of arthropods and other animals. Naturally, there has to be a balance between naturally grown, wild areas as well as mown grass areas. Increase in semi-natural vegetation has its dangers in a tropical context (e.g., poisonous snakes), particularly for staff and students on a university campus. There is considerable diversity of butterflies on the Amravati campus, to which five more species have been added; 32 species are common and a further 16 species relatively rare. The study not only confirms the importance of providing nectar resources for butterflies, but also reveals what kind and variety of resources are most appropriate for the butterfly fauna. Longer-lived trees provide fewer nectar resources than shorter-lived shrubs and herbs. The Botanical Garden, the University Garden and the University Dam at Amravati University are some of the rich butterfly areas on the campus and it follows that increasing these areas by planting additional nectar plants and increasing water resources would be valuable steps in the conservation of butterfly diversity on the campus. It is clear, from the specific associations of nectar visits to plants, that the obverse, a lack of flowering plants on the campus would have serious implications for the butterfly fauna and the maintenance of their populations.

Of course, this is but one aspect of resource use of butterflies on the university campus and a complete picture of habitat structure can only be obtained by research into all consumable and utility resources (Dennis et al. 2003). Butterfly populations would clearly benefit from planting indigenous, as opposed to exotic, nectar and larval host plants. In particular, attention should be paid to the seasonal availability of resources and to resources for less common butterflies on the campus. All in all, the campus provides rich ground not just for conservation but also for research into butterfly and arthropod biology for the students attending biology and ecology courses.

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Elachista imatrella Schantz, 1971 (Elachistidae): Female external morphology and redescription of the male

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Abstract. The female external morphology of *Elachista imatrella* Schantz, 1971 is described based on a single female specimen lacking the abdomen. The male *E. imatrella* is redescribed on the basis of new material and compared with a close relative, *E. cinereopunctella* (Haworth, 1828). The species can be distinguished most reliably by the length and shape of the aedeagus. The wing pattern of *E. imatrella* is more distinct than presumed earlier. The habitat of *E. imatrella* is described and its possible life history discussed.

Key words. Elachistidae, *Elachista imatrella*, *Elachista cinereopunctella*, taxonomy, morphology, redescription.

Introduction

Elachista imatrella Schantz, 1971 was described on the basis of three male specimens collected in the vicinity of Imatra, south-eastern Finland (Schantz 1971). Later, five additional, old, and unlabelled specimens were recorded from Norway (Traugott-Olsen & Schmidt Nielsen 1977). These were the only known records of this species until it was rediscovered in Finland in 1993 (Kaila & Kerppola 1995). Those findings were made in Rovaniemi, northern Finland, where two male specimens were found by L. Sippola. Soon after that (when mapping the lepidopterous fauna of the planned Vuotos water reservoir area in Pelkosenniemi in 1994), MM captured one male specimen of this rarity by kicking it off a spruce tree in a fen area (Itämies & Mutanen 1995, 1996). This locality was later visited by other lepidopterists and three more specimens were collected in 1996 (R. Siloaho and Henry Holmberg, pers. comm.). When the Norwegian specimens were later re-examined, they were considered to belong to *E. cinereopunctella* (Haworth, 1828) (L. Aarvik, pers. comm.). Therefore, *E. imatrella* is known only from Finland, and a total of nine specimens are nowadays available. The female genitalia still remain unknown as the only known female specimen, collected from Pelkosenniemi, Lapland (H. Holmberg leg.) unfortunately lacks the abdomen.

E. imatrella is closely related to *E. cinereopunctella* (see Traugott-Olsen & Schmidt Nielsen 1977). The following male characteristics are mentioned as diagnostic (Traugott-Olsen & Schmidt Nielsen 1977, Kaila & Kerppola 1995): 1. The wing pattern of *E. imatrella* is very indistinct, whereas that of *E. cinereopunctella* is conspicuous; 2. *E. imatrella* is smaller on average; 3. The aedeagus of the male genitalia of *E. imatrella* is very long and slender, whereas in *E. cinereopunctella* it is much shorter and also slightly thicker. The species further differ considerably in their ecology, *E. imatrella* being confined to bogs and *E. cinereopunctella* to sandy or calcareous areas with shady spots (Traugott-Olsen & Schmidt Nielsen 1977). The more recent findings of *E. imatrella* have proved that some of the previously described characteristics either show intraspecific variation or are due to the worn condition of the type material.

In this paper, we describe the external morphology of the female and redescribe the external and genital morphology of the male *E. imatrella*. We also comment on the reliability of the above-mentioned diagnostic characteristics between *E. imatrella* and *E. cinereopunctella* and provide diagnostic features for the males of the species.

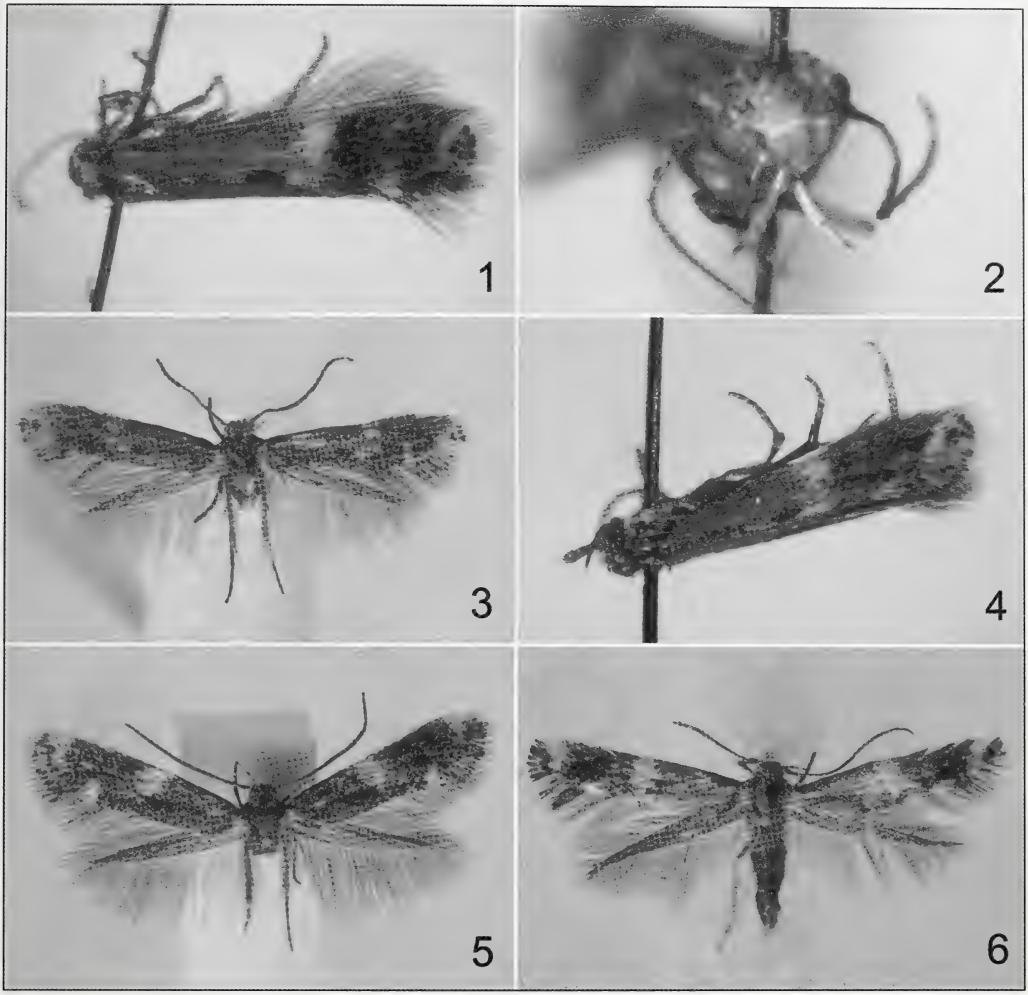
Elachista imatrella Schantz, 1971

Material. *E. imatrella*: 1♂ Finland, Sa Imatra, 23.vi.1938, von Schantz leg. (slide 531/1964, von Schantz); 1♂ KemLE: Pelkosenniemi 7456:538, 21.vi.1994, Mutanen leg. (slide 867 J. Itämies); 1♂ PPn: Rovaniemi, 25.vi.1993, Sippola leg. (slide 585 M. Mutanen); 1♂ KemLE: Pelkosenniemi, 26.vi.1996, Siloaho leg.; 1♀ KemL: Savukoski 745:53 (mislabelled, the correct municipality is Pelkosenniemi), 29.vi.1996, Holmberg leg., *E. cinereopunctella*: 2♂, 1♀ Estonia, Saaremaa, 20.vi.1994, Nupponen leg. (slides 573, 574 Mutanen); 2♂ Austria, 20.v.1992, Biesenbaum leg. (slides 1390, 3501 Kaila); 1♂ Poland, Tatra Mountains, Nosul, 1150 m, 3.vii.1987, Buszko leg. (slide 3502 Kaila); 1♂ Russia, Aunus, 19.vi.1991, Kullberg leg (slide 3503 Kaila).

Female, external morphology (Figs. 1–2). Forewing length 3.4 mm. Labial palpus ascending; about as long as diameter of head; white above, except for tip of 3rd segment, narrowly grey, greyish below. Antennae grey, scales slightly raised on distal two thirds. Head creamy white. Neck tuft mottled grey (tips of scales greyish). Thorax and tegula mottled grey. Forewing ground colour mottled greyish/brownish from base to fascia, blackish beyond. Straight fascia situated beyond middle of costa, white and distinct, faintly broken in middle and hardly reaching dorsum. Fold area with black dot touching fascia. Tornal spot white and small. Faint white apical spot present. Tornal fringe scales grey, apical fringe scales white with clear fringe line. Legs greyish, hind leg pale inwardly. Tarsal articles grey, with broad white tip.

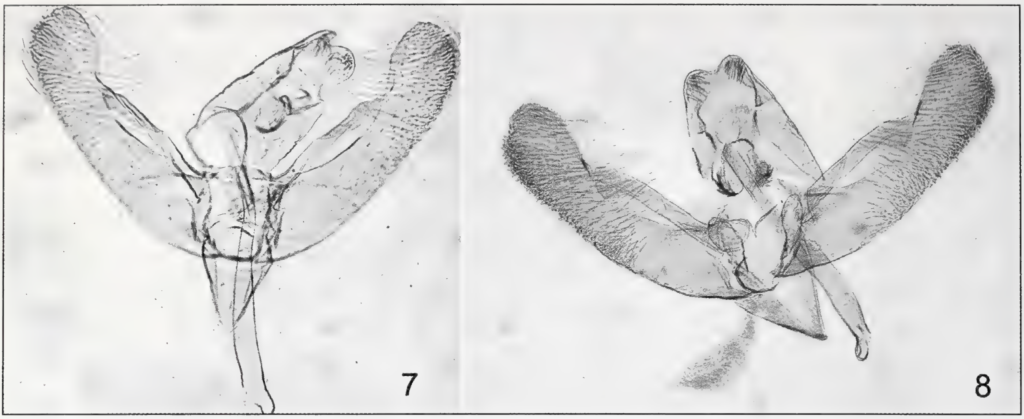
Male, redescription (Figs. 3–4, 7). Forewing length 3.2–3.7 mm. Labial palpus proximally greyish white, distally with dark brown-tipped scales. Head yellowish white with brownish scales between antennae. Neck tuft yellowish white, scales dark-tipped. Antennae dark brown, slightly serrated. Tegula and thorax brownish grey. Forewing ground colour greyish brown, with basally whitish scales giving mottled appearance; with three whitish markings varying in intensity; basal spot absent; fascia situated at 3/5 and not reaching dorsum; tornal spot small but distinct; apex with distinct, ochreous white streak-like spot; fringe line distinct, fringe yellowish white. Hindwing light greyish brown.

Male genitalia. Uncus lobes rounded with shallow u-shaped indentation between them. Gnathos bilobed, gnathos lobes elliptical. Distal margin of juxta lobes almost straight; digitate process broadly club-shaped, narrow at base; valva proximally broadest, narrowest before rounded and rather prominent cucullus; costal folds wide and prominent; valva length (0.521–0.581 mm). Saccus v-shaped, medial ridge not visible. Aedeagus length 0.559–0.599 mm and maximum width 0.029–0.039 mm, aedeagus comparatively long (1.00–1.01 times length of valva), slender and distally bent beyond slightly sclerotized ridges, vesica without cornuti.



Figs. 1–6. External appearance of *Elachista imatrella* and *E. cinereopunctella*. **1–2.** *E. imatrella* ♀ and head, Finland, KemL: Savukoski 745:53, 29.vi.1996, Holmberg leg. **3.** *E. imatrella* ♂, Finland, KemLE: Pelkosenniemi 7456:538, 21.vi.1994, Mutanen leg. **4.** *E. imatrella* ♂, Finland, KemLE: Pelkosenniemi, 26.vi.1996, Siloaho leg. **5.** *E. cinereopunctella* ♂, Estonia, Saaremaa, 20.vi.1994, Nupponen leg. **6.** *E. cinereopunctella* ♀, Estonia, Saaremaa, 20.vi.1994, Nupponen leg.

Diagnosis. The *E. imatrella* male is externally similar to that of *E. cinereopunctella* (see Figs. 5–6). The intensity of the wing pattern of *E. imatrella* seems to vary: wing markings may be clear or less pronounced, but hardly ever absent in fresh specimens (Figs. 3–4). The fascia is more outwardly situated in *E. imatrella* than in *E. cinereopunctella*, in which it is situated before the middle of the costa. *E. imatrella* is smaller on average than *E. cinereopunctella*, but there is some overlap because the forewing length of the studied *E. cinereopunctella* specimens varied from 3.6 to 4.0 mm. The species are most



Figs. 7–8. ♂ genitalia of *Elachista imatrella*. **7.** Finland, KemLE: Pelkosenniemi 7456:538, 21.vi.1994, Mutanen leg. **8.** *E. cinereopunctella*, Estonia, Saaremaa, 20.vi.1994, Nupponen leg.

reliably distinguishable based on the male genitalia, particularly the aedeagus, which is both absolutely and relatively longer in *E. imatrella*. In *E. cinereopunctella* the length of the aedeagus varies from 0.477 to 0.530 mm (n=6), being statistically significantly shorter than in *E. imatrella* (t=7.24, df=9, $p<0.001$). The ratio between aedeagus and valva is 0.86–0.93 in *E. cinereopunctella*, but 1.00–1.01 in *E. imatrella*. However, this difference appears less prominent than presented by Traugott-Olsen & Schmidt Nielsen (1977), since the illustrated aedeagus of *E. imatrella* represents the extreme type. The maximum width of the *E. cinereopunctella* aedeagus (0.028–0.035 mm) is the same as in *E. imatrella*, but the shorter aedeagus also appears stouter (see Figs. 7–8). The distal end of the aedeagus of *E. cinereopunctella* is straight or only very slightly bent (Fig. 8). Due to the scarcity of *E. imatrella* specimens in collections, the reliability of the diagnostic characteristics is slightly doubtful. The length of the aedeagus varies to the extent of possible overlap at the junction of the distributions. The females of these species closely resemble each other externally, but the fascia of *E. cinereopunctella* is more proximally situated. Additional specimens of *E. imatrella* may reveal further external differences between females, and additional characteristics are potentially diagnostic in female genitalia.

Life history. Unknown. The species is confined to boggy habitats. The type series was collected flying over *Eriophorum vaginatum*, which was considered the plausible food plant by Schantz (1971). We consider this an improbable food plant for several reasons: Firstly, this plant is very scarce in the Pelkosenniemi habitat. Secondly, because *E. vaginatum* is often a dominant plant species in bogs in Finland, more findings of *E. imatrella* could be expected if *E. vaginatum* really were the host plant. Thirdly, there are almost always a number of sedge (*Carex*) species present together with *Eriophorum*, and since the close relative *E. cinereopunctella* is confined to certain sedges, we believe that some species of *Carex* are more probable food plants for *E. imatrella*. The locality in Pelkosenniemi is a woody bog, with spruce and pine trees mostly less than five meters tall. Dwarf birch (*Betula nana*) stands are dense in many places. The most abundant sedges are *Carex globularis* and *C. vaginata*. The latter typically grows around and under spruce trees, from where some *E. imatrella* adults were also swept (R. Siloaho, pers. comm.). One male specimen was caught by kicking it on flight high up from a spruce tree. In August 2000, MM, together with Tomi Mutanen, visited the place and found several empty and some inhabited *Elachista* mines on *C. vaginata*, but this rearing did not yield adults. No mines were found on *C. globularis* or *E. vaginatum* despite intensive search. We therefore consider *C. vaginata* the more probable food plant for *E. imatrella*. We have also visited the Rovaniemi locality, which resembles that of Pelkosenniemi, but has more open areas with rich *Eriophorum* and *Carex* growths. The adult of *E. imatrella* seems to be on the wing very early in the summer, in June, and we therefore consider it probable that the larva reaches maturity in autumn. When the first specimen from Pelkosenniemi was collected, species overwintering at the pupal stage (e. g. *Phyllonorycter salicicolellus* (Sircom, 1848), *P. rolandi* (Svensson, 1966), and *Callisto coffeella* (Zetterstedt, 1839)) had just started their flight.

Discussion

The genital differences between many species groups of Elachistidae are extremely slight (see e. g. Kaila *et al.* 2001; Kaila & Junnilainen 2002; Kaila & Varalda 2004). In many cases, the differentiation of a species is based not only on differences in its external and genital morphology, but on a combination of morphological, biological, and distributional data. This is also the case in *E. imatrella*, since the morphological differences compared to *E. cinereopunctella* are slight. To our knowledge the two species live in different geographical areas and inhabit different habitats. There may be a reason for caution, however. Many lepidopteran species, such as *Clepsis pallidana* (Fabricius), *Thalera fimbrialis* (Scopoli), and *Lacanobia w-latinum* (Hufnagel), that are found in warm and dry localities in southern and central Europe, live mainly in bogs and other moist habitats in Scandinavia (Mikkola & Jalas 1977; Mikkola *et al.* 1985; Skou 1991; personal observations). Because we found intraspecific genital variation small in both species and the genital differences to be constant over the whole ranges and particularly between the closest population of *E. cinereopunctella* and *E. imatrella* in south-eastern Fennoscandia, we consider the possibility of geographic intraspecific variation in genitalia very improbable.

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Apatema impunctella Amsel, 1940, stat. rev. (Autostichidae)

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Zusammenfassung. Für *Apatema fasciata* f. *impunctella* Amsel, 1940 wird der Lectotypus festgelegt, die Art wird als bona species wieder eingesetzt und mit der nahe stehenden *Apatema apolausticum* Gozmany, 1996 verglichen.

Abstract. The author designed the lectotype for *Apatema fasciata* f. *impunctella* Amsel, 1940. The species is considered as bona species and is compared with the closely related *Apatema apolausticum* Gozmany, 1996.

Key words. *Apatema impunctella*, nomenclature, lectotype designation

Vorbemerkungen

Die Gattung *Apatema* Walsingham, 1900 ist in Europa einschließlich der Kanarischen Inseln mit 11 Arten vertreten. Die Genitaluntersuchung einer Reihe von Exemplaren zeigte die Notwendigkeit einer Revision dieser Gattung. Vorliegende Arbeit ist als ein Beitrag dazu aufzufassen.

1940 hat Amsel *Apatema fasciata* f. *impunctella* beschrieben. Er schreibt: “Bei *fasciata* tritt nun eine Form auf, die durch das Fehlen des schwarzen Punktes in der gelben Mittelbinde ausgezeichnet ist. ... Diese Form *impunctella* liegt mir vor aus: Ragusa (Dalmatien) 15.–30.9.30, Kiriath Anavim (Jerusalem) 2.5.1930, und aus Sardinien von den Fundorten: Sadali 5.7.1936, Desulo 8.7.1936, Sacasa bei Aritzo 21.–29.7.1930, sämtliche Stücke von mir gesammelt.“

1952 befasste sich Amsel nochmals mit *impunctella* und bildet ohne weitere, nähere Angabe ein männliches Genital von *impunctella* ab, vergleicht dieses mit *fasciata* (Stainton, 1859) und erhebt *impunctella* in den Artrang. 1977 stellt dann Gozmany *impunctella* Amsel, fälschlich mit der Jahreszahl 1952 kombiniert, als Synonym zu *A. mediopallidum* Walsingham, 1900.

Nach Artikel 45.6.4 des ICZN (2000) ist der Name *impunctella* als subspezifisch anzusehen (erstmals vor 1961 veröffentlicht und ausdrücklich mit der Bezeichnung „f.“ verwendet). Die korrekte Bezeichnung ist deshalb: *Apatema fasciata impunctella* Amsel, 1940.

Verwendete Abkürzungen

DEI	Deutsches Entomologisches Institut, Müncheberg
ÜMB	Überseemuseum Bremen.
ZSM	Zoologische Staatssammlung München

Ergebnisse

Im ÜMB befinden sich fünf weibliche Exemplare von *impunctella*, deren Fundorte Amsel 1940 aufgezählt hat. Diese Tiere haben ein rotes Etikett: „Paratypus leg. H. Amsel / A. fasciata f. impunctella”. Weil Amsel in der Originalbeschreibung keine

Typenkennzeichnung veröffentlicht hat, sind die vorliegenden fünf Exemplare als Syntypen anzusehen.

Das von Amsel angeführte Exemplar von Kiriath Anavim wurde weder im ÜMB noch an Amsels späterer Arbeitsstätte, dem Staatlichen Museum für Naturkunde Karlsruhe, vorgefunden.

Von einem Syntypus liegt ein Genitalpräparat vor. Dieses Exemplar wird als Lectotypus ausgewählt und hiermit festgelegt. Die Festlegung des Lectotypus erfolgt nach Artikel 74.7.3 des ICZN (2000) und dient der nomenklatorischen Stabilität.

Der Vergleich des Genitals des Lectotypus (Fig. 5) mit den Genitalien der anderen Arten zeigt eine starke Ähnlichkeit zu *A. apolausticum* Gozmany, 1996 (Figs. 8–9), während bei *mediopallidum* der Ductus bursae symmetrisch ist.

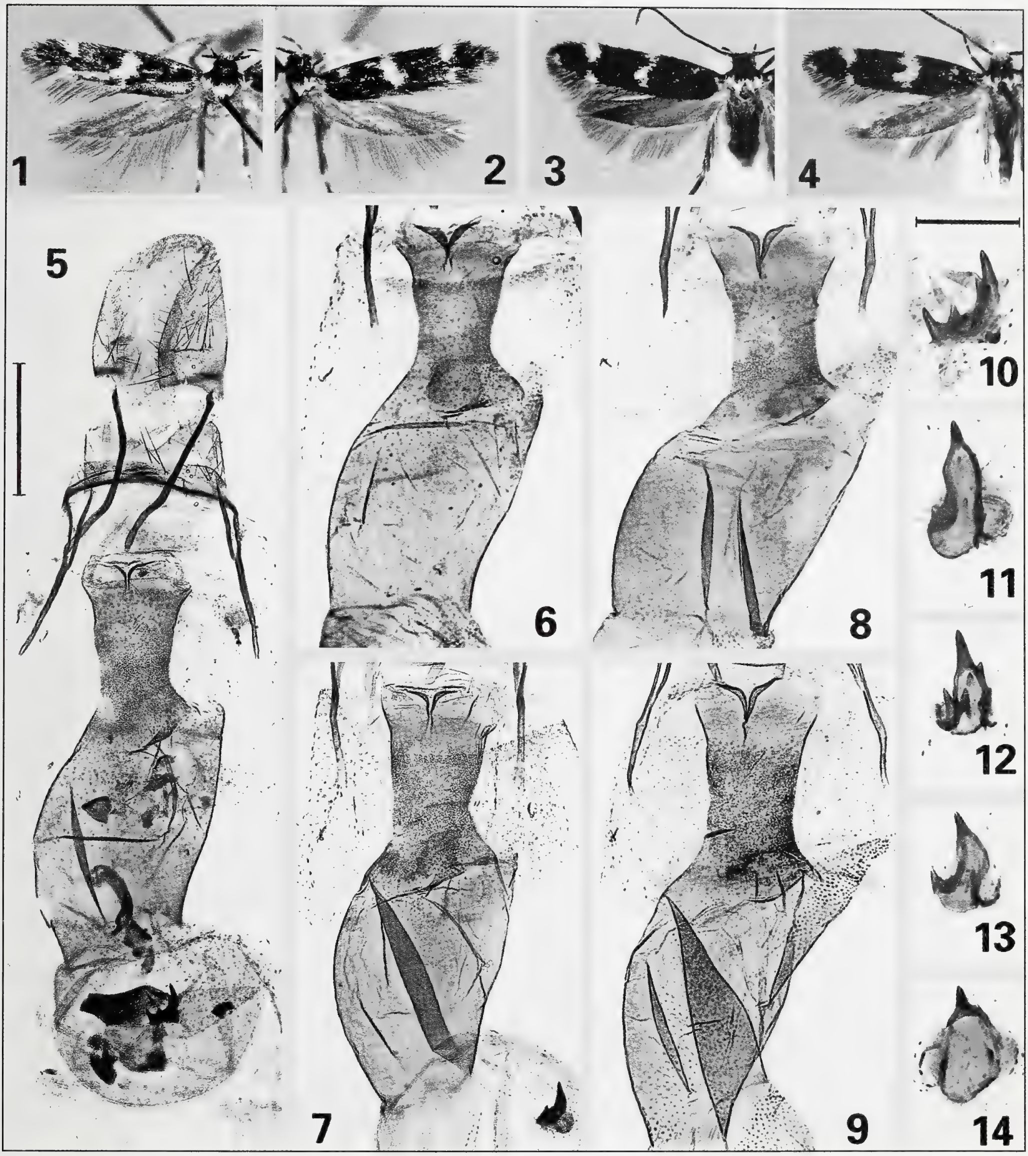
Der Lectotypus von *A. impunctella* wurde mit 17♂ und 20♀ von Sardinien verglichen. Weil sich sowohl die Männchen als auch die Weibchen genitalmorphologisch untereinander gleichen, gehören alle diese Exemplare zu *A. impunctella*. Der Vergleich mit Präparaten von *A. apolausticum* von Rumänien (Terra typica Baile Herculane), Slowenien, Kroatien, Albanien, Bulgarien und Griechenland zeigt bei den Männchen unterschiedliche Phalli, während bei den Weibchen nur geringe und nicht immer deutliche Unterschiede der Genitalien bestehen. Aufgrund der konstanten Unterschiede der Phalli liegen zwei valide Arten vor.

Apatema impunctella Amsel, 1940, stat. rev.

Material. Lectotypus *A. impunctella*, ♀: 1.: Fundortetikett in Schreibmaschinenschrift, fotografisch verkleinert: „Aritzo Sacasa 24.7.1936 H. G. Amsel"; 2.: rotes Etikett: Oberseite gedruckt „Paratypus leg. H. Amsel", Unterseite handschriftlich „A. fasciata f. impunctella"; 3.: rotes Etikett: „Lectotypus ♀ Apatema impunctella Amsel, 1940 des. Sutter 2005"; 4.: weißes Etikett, handschriftlich in Blau „608"; 5.: das zwischen Deckgläsern eingebettete Genital (Fig. 5), oberseitig beschriftet „Aritzo Sacasa 24.VII.36, edt. E. Jäckh 19" und überklebt „608" und unterseitig in Rot Jäckh's Präparatnummer „5504", coll. ÜMB. – Paralectotypen *A. impunctella*: 1♀ Aritzo, Sacasa, 29.VII.1936, H. G. Amsel; 1♀ Desulo, Sardegna, 8.VII.1936, H. G. Amsel; 1♀ ohne Abdomen von Sadali, Sardegna, 5.VII.1936, H. G. Amsel leg., 1♀ Ragusa, Dalmatien, 15.–30.IX.1930, Amsel leg. [Fehlbestimmung], coll. ÜMB.

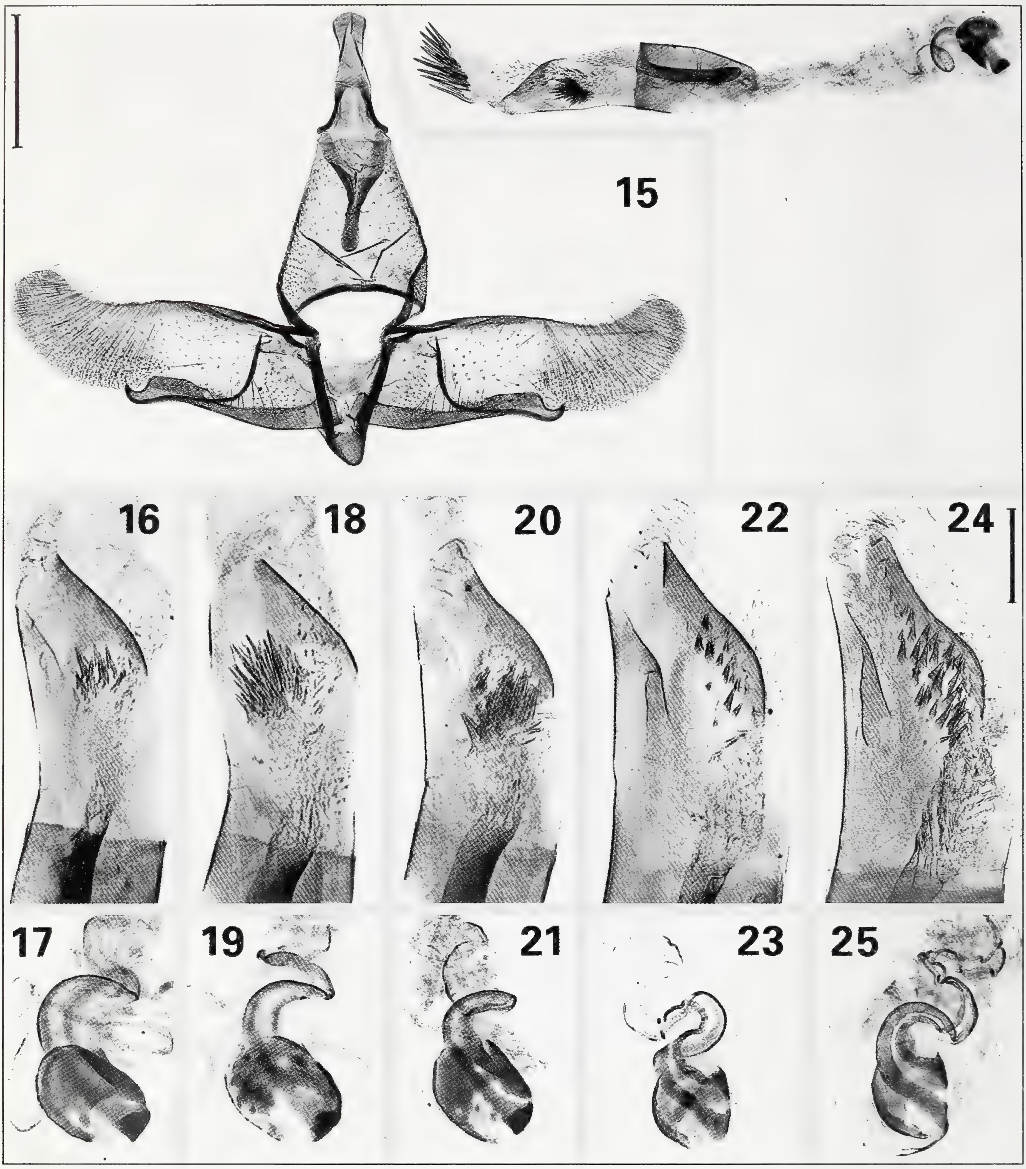
Genitaluntersuchtes Material *A. impunctella*: 1♂ **Italien, Sardinien, Prov. Nuoro**, Gennargentu, Arcu Tascussi 25.VII.1981 leg. et coll. Baldizzone; 3♂, 4♀ Villanova Strisaili, 885 m, 19., 24.,VII, 1., 7.VIII.1983, 27.VII.1984, leg. Kuchlein, coll. Kuchlein, Sutter; 1♀, gleiche Daten, aber 930 m, 24.VII.1984, leg. Kuchlein, coll. Sutter; 1♀ Orgosolo, 1080 m, 30.VII.1984, leg. Kuchlein, coll. Sutter (Fig. 13); 2♂, 3♀ **Prov. Cagliari**, Domusnovas, Sa Duchessa, 350 m, 28., 30.VI., 2.VII.2004, (Figs. 6, 11, 15); 1♂, 2♀ Monte Arcosu bei Sa Canna, 22.–24.VI.2004; 2♂, 1♀ gleiche Daten, aber 100 m, 22., 23.VI.2004 (Fig. 7); 4♂, 1♀ gleiche Daten, aber 150 m, 24.VI., 3.VII.2004 (Figs. 18, 19); 2♀ Monte Arcosu bei Su Tragu, 27., 29.VI.2004; 2♂, 2♀ gleiche Daten, aber 130 m, 29.VI, 1.VII.2004 (Figs. 4, 16, 17); 1♂, 2♀ Monte Arcosu bei Perdu Melis, 320 m, 25.VI., 3.VII.2004 (Fig. 12); 1♂, 1♀ Monte Arcosu bei Paddera 600 m, 26.VI.2004 (Fig. 3), leg. et coll. Baldizzone & Triberti. 1♂ **Italien, Festland**, Prov. Alessandria, Piemonte, Capanne di Marcarolo, Gli Olmi, 758 m, 12.VII.2002, leg. et coll. Baldizzone; 1♂, 1♀ Prov. Livorno, Antignano, 10 m, 26.VI.2004 (Figs. 20, 21), leg. et coll. Liška. 2♂, 1♀ **Frankreich, Korsika**, St. Lucia di Porto Vecchio, 19., 20.VI.1993, leg. et coll. Liška; 1♂, 1♀ Bastia-Poretta, Plage de Pineto, 12.VII.1993, leg. Liška, ♂ coll. Liška, ♀ coll. Sutter (Fig. 14). 1♂ **Frankreich, Festland**, Esterelgebirge bei St. Raphael, 50 m, 8.VII.1928, leg. Koschabek, coll. ZSM.

Abgebildetes Vergleichsmaterial von *A. apolausticum*: 1♀ **Kroatien**, Insel Krk, Risica, 0–50 m, 25.–29.VI.2000 (Fig. 8), leg. Liška, coll. Sutter. 1♂ **Bulgarien**, Nessebar, 11.–23.VII.1959 (Fig. 22), leg. Soffner, coll. DEI; 2♂ Pirin, Liljanowo, 1.–30.VI.1984 (Fig. 23) und 27.VI.–25.VII.1985 (Figs. 24, 25) leg. Eichler, coll. ZSM. 1♀ **Griechenland**, Lakonia, 5 km südl. Monemvasia, 1.VI.1983 (Fig. 9), leg. Christensen, coll. ZSM.



Figs. 1–7, 10–14. *Apatema impunctella* Amsel, Falter, Genital ♀ und Signa. **1, 2, 5, 10.** Lectotypus GU 5504 Jäckh, coll. ÜMB. **6.** Sardinien, GU 7300 Sutter, coll. Baldizzone. **7.** Sardinien, GU 7355 Sutter, coll. Baldizzone. **3, 4, 11–13.** Sardinien. **14.** Korsika.
Figs. 8–9. *Apatema apolausticum* Gozmany, Genital ♀. **8.** Kroatien, GU 6479 Sutter, coll. Sutter. **9.** Griechenland, GU 6518 Sutter, coll. ZSM. (Maßstab: Genitale 0,3 mm, Signa 0,1 mm)

Beschreibung des Lectotypus, ♀ Falter (Figs. 1–2). Vorderflügelspanne 9 mm, Kopf oben bis zu den Fühlerwurzeln braun mit hellen Unterschuppen, zwischen den Augen weiß beschuppt. Von den Fühlern sind nur Reste vorhanden. Das Palpenmittelglied ist außen weißlich und braun, das Endglied überwiegend schwarzbraun beschuppt. Vorderflügel dunkelbraun mit weißer Zeichnung, die Hinterflügel graubraun.



Figs. 15–21. *Apatema impunctella* Amsel, Genital ♂, Detail des Phallus und Lamina. **15.** Sardinien, GU 7304 Sutter, coll. Baldizzone. **16, 17.** Sardinien, GU 7308 Sutter, coll. Baldizzone. **18, 19.** Sardinien, GU 7272 Sutter, coll. Triberti. **20, 21.** Italien, Provinz Livorno, GU 7346 Sutter, coll. Liška.
Figs. 22–25. *Apatema apolausticum* Gozmany, Detail des Phallus und Lamina. **22.** Bulgarien, Nessebar, GU 6442 Sutter, coll. DEI. **23.** Bulgarien, Pirin-Geb., GU 7340 Sutter, coll. ZSM. **24, 25.** Bulgarien, Pirin-Geb., GU 7357 Sutter, coll. ZSM. (Maßstab: Genital 0,3 mm, Detail des Phallus und Lamina 0,1 mm)

Diagnose (Figs. 1–4). Vorderflügelspanne 8–11 mm (Durchschnitt ♂ 9,7 mm, ♀ 9,3 mm). Kopf oben meist fast bis zu den Fühlerwurzeln schwarzbraun und zwischen den Augen weiß oder gelblichweiß. Palpen unregelmäßig dunkel beschuppt. Fühler im basalen Drittel beim ♂ ungeringelt, beim ♀ meist hell geringelt, aber auch undeutlich heller geringelt oder ungeringelt; die Endglieder der Fühler nicht heller abgesetzt. 2. Thorakaltergit und Tegulae ausgedehnt weiß, auch gelblich weiß. Tergite I–II hell gelbocker, die folgenden grau, das Ende oft heller. Sternite medial heller grau, auch ockerfarben aufgehellt. Vorderflügel schwarzbraun mit variabler, weißer Zeichnung, besonders bei geflogenen Tieren auch gelblichweiß. Hinterflügel graubraun.

Genital ♂ (Figs. 15–21). Phallus distal asymmetrisch. Die Vesica ist proximal sklerotisiert. Im häutigen Teil der Vesica sind fleckartig große Cornuti angeordnet. Diese sind relativ lang und dünn, meist in großer Anzahl (Figs. 18, 20), selten weniger (Fig. 16). Das Ende der Vesica ist schräg und ± gleichmäßig mit nadelförmigen Cornuti besetzt. Der Ductus ejaculatorius ist anterior des Phallus in elliptischer Form sklerotisiert (Figs. 17, 19, 21), eine Lamina im Sinne von Sattler (1979).

Genital ♀ (Figs. 5–7). Ductus bursae zwischen Bursa und dem Abgang des Ductus seminalis asymmetrisch und in der distalen Hälfte dieses Ductusteiles medial ± deutlich körnchenförmig strukturiert (Fig. 7). Der Ductus ist dorsal schwach konvex und lässt sich meist gut verebnen. Unverebnet entsteht eine schräge Falte (Fig. 7). Die Querfalte des Ductus vor dem Ostium ist für die Artunterscheidung ohne Aussage und in Figs. 5–7 verebnet. Signum der Bursa variabel (Figs. 11–14, Fig. 10 lateral).

Differentialdiagnose. Im Phallus von *A. apolausticum* (Figs. 22, 24) sind die großen Cornuti der Vesica in einem langgezogenen Feld verstreut. Diese Cornuti sind kürzer und basal breiter als bei *A. impunctella*, ihre Anzahl ist ebenfalls variabel. Im weiblichen Genital von *A. apolausticum* ist der Ductus bursae zwischen der Bursa und dem Abgang des Ductus seminalis im Durchschnitt breiter (Fig. 8) als bei *A. impunctella* (Fig. 6) und ± körnchenförmig strukturiert (Fig. 9).

Verbreitung. Die Nachweise basieren auf Lichtfängen in Höhenlagen bis zu 1080 m auf Sardinien und Korsika. Auf dem Festland wurde *A. impunctella* durch Männchen nachgewiesen vom Esterelgebirge (St. Raphael), aus dem Piemont (Capanne di Marcarolo, Gli Olmi) sowie aus der Provinz Livorno (Antignano).

Anmerkungen. In Amsels Veröffentlichung wird für die Funde von Aritzo Sacasa das Funddatum fälschlich mit 21.–29.7.1930 angeführt, während auf den Fundortetiketten das Jahr 1936 angegeben ist.

Der Syntypus von Ragusa (Dalmatien) ist eine Fehlbestimmung von *A. apolausticum*.

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